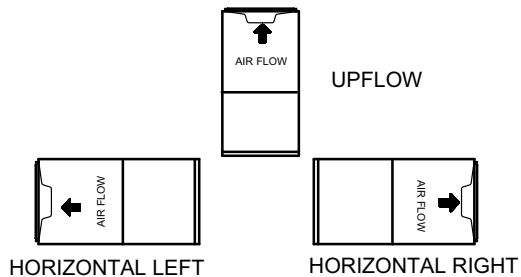




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Dallas, Texas, USA



# INSTALLATION INSTRUCTIONS ML193UH

MERIT® SERIES GAS FURNACE  
UPFLOW / HORIZONTAL AIR DISCHARGE

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Supersedes 06/2013

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Publications  
Litho U.S.A.

**THIS MANUAL MUST BE LEFT WITH THE  
HOMEOWNER FOR FUTURE REFERENCE**

This is a safety alert symbol and should never be ignored. When you see this symbol on labels or in manuals, be alert to the potential for personal injury or death.

**CAUTION**  
As with any mechanical equipment, personal injury can result from contact with sharp sheet metal edges. Be careful when you handle this equipment.

**WARNING**  
Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or loss of life. Installation and service must be performed by a licensed professional HVAC installer (or equivalent), service agency or the gas supplier.

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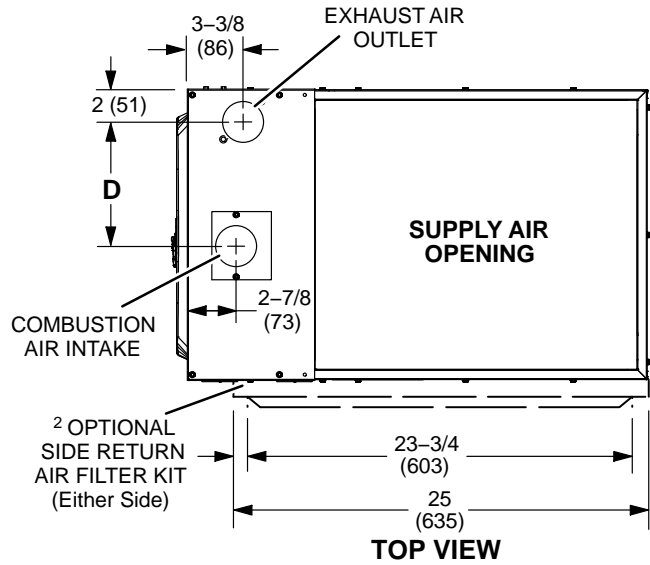
## ML193UH Unit Dimensions - inches (mm)

<sup>1</sup>NOTE – 60C and 60D size units that require air volumes 1800 cfm or over (850 L/s) must have one of the following

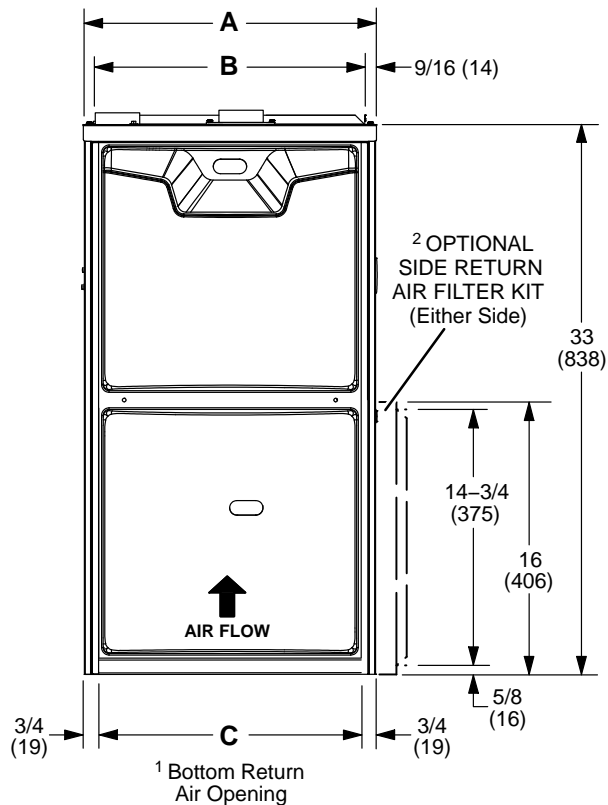
1. Single side return air with transition, to accommodate 20 x 25 x 1 in. (508 x 635 x 25 mm) cleanable air filter. Required to maintain proper air velocity.
2. Single side return air with optional Return Air Base
3. Bottom return air.
4. Return air from both sides.
5. Bottom and one side return air.

See Blower Performance tables for additional information.

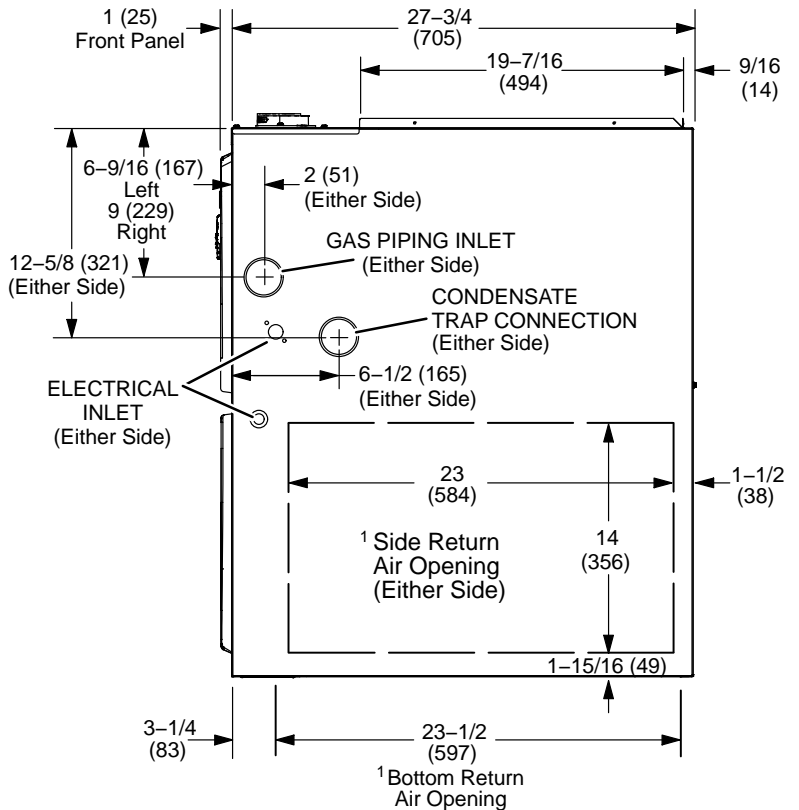
<sup>2</sup>Optional External Side Return Air Filter Kit is not for use with the optional Return Air Base.



**TOP VIEW**



**FRONT VIEW**



**SIDE VIEW**

ML193UH Model No.	A		B		C		D	
	in.	mm	in.	mm	in.	mm	in.	mm
045XP24B 045XP36B 070XP24B 070XP36B	17-1/2	446	16-3/8	416	16	406	7-5/8	194
090XP36C 090XP48C 110XP48C 110XP60C	21	533	19-7/8	505	19-1/2	495	9-3/8	238
135XP60D	24-1/2	622	23-3/8	594	23	584	11-1/8	283

## ML193UH Gas Furnace

The ML193UH Category IV gas furnace is shipped ready for installation in the upflow or horizontal position. The furnace is shipped with the bottom panel in place. The bottom panel must be removed if the unit is to be installed in horizontal or upflow applications with bottom return air.

**The ML193UH can be installed as either a Direct Vent or a Non-Direct Vent gas central furnace.**

The furnace is equipped for installation in natural gas applications. A conversion kit (ordered separately) is required for use in propane/LP gas applications.

**NOTE** - In Direct Vent installations, combustion air is taken from outdoors and flue gases are discharged outdoors. In Non-Direct Vent installations, combustion air is taken from indoors or ventilated attic or crawlspace and flue gases are discharged outdoors. See figures 1 and 2 for applications involving roof termination.

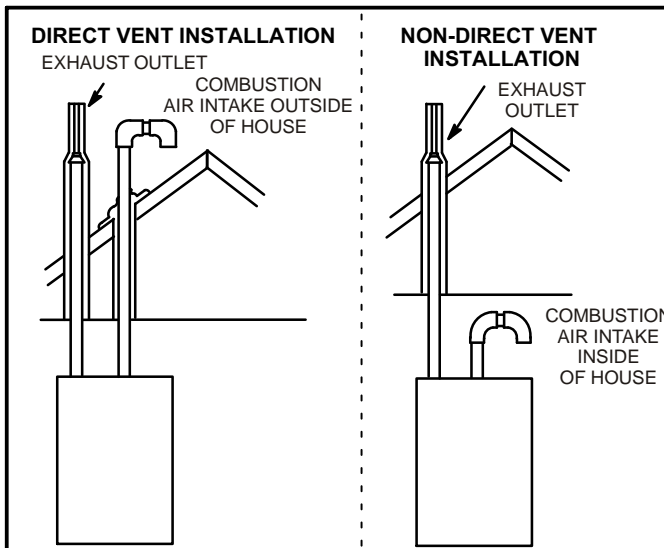


FIGURE 1

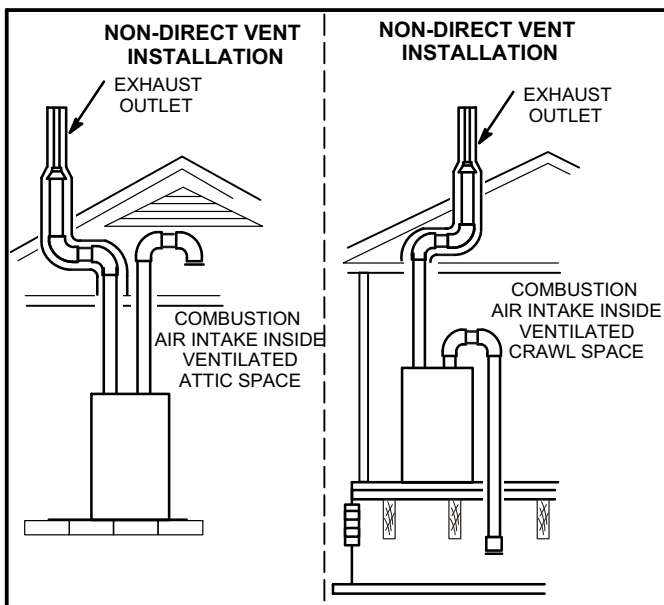


FIGURE 2

## Shipping and Packing List

### Package 1 of 1 contains

- 1 - Assembled ML193UH unit
- 1 - Bag assembly containing the following:
  - 1 - Snap bushing
  - 1 - Snap plug
  - 1 - Wire tie
  - 1 - Condensate trap
  - 1 - Condensate trap cap
  - 1 - Condensate trap clamp
  - 1 - 2" diameter debris screen
  - 1 - 3/4" Threaded street elbow

Check equipment for shipping damage. If you find any damage, immediately contact the last carrier.

The following items may also be ordered separately:

- 1 - Thermostat
- 1 - Propane/LP changeover kit
- 1 - Return air base kit
- 1 - Horizontal suspension kit

## Safety Information

### ⚠ WARNING

Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or loss of life. Installation and service must be performed by a licensed professional installer (or equivalent), service agency or the gas supplier.

### ⚠ CAUTION

As with any mechanical equipment, personal injury can result from contact with sharp sheet metal edges. Be careful when you handle this equipment.

### ⚠ DANGER

Danger of explosion.

There are circumstances in which odorant used with LP/propane gas can lose its scent. In case of a leak, LP/propane gas will settle close to the floor and may be difficult to smell. An LP/propane leak detector should be installed in all LP applications.

Use only the type of gas approved for use with this furnace. Refer to unit nameplate.

ML193UH units are CSA International certified to ANSI Z21.47 and CSA 2.3 standards.

### Building Codes

In the USA, installation of gas furnaces must conform with local building codes. In the absence of local codes, units must be installed according to the current National Fuel Gas Code (ANSI-Z223.1/NFPA 54). The National Fuel

Gas Code is available from the following address:

American National Standards Institute, Inc.  
11 West 42nd Street  
New York, NY 10036

In Canada, installation must conform with current National Standard of Canada CSA-B149 Natural Gas and Propane Installation Codes, local plumbing or waste water codes and other applicable local codes.

In order to ensure proper unit operation in non-direct vent applications, combustion and ventilation air supply must be provided according to the current National Fuel Gas Code or CSA-B149 standard.

### Installation Locations

This furnace is CSA International certified for installation clearances to combustible material as listed on the unit nameplate and in the table in figure 12. Accessibility and service clearances must take precedence over fire protection clearances.

**NOTE** - For installation on combustible floors, the furnace shall not be installed directly on carpeting, tile, or other combustible material other than wood flooring.

For installation in a residential garage, the furnace must be installed so that the burner(s) and the ignition source are located no less than 18 inches (457 mm) above the floor. The furnace must be located or protected to avoid physical damage by vehicles. When a furnace is installed in a public garage, hangar, or other building that has a hazardous atmosphere, the furnace must be installed according to recommended good practice requirements and current National Fuel Gas Code or CSA B149 standards.

**NOTE** - Furnace must be adjusted to obtain a temperature rise within the range specified on the unit nameplate. Failure to do so may cause erratic limit operation and premature heat exchanger failure.

This ML193UH furnace must be installed so that its electrical components are protected from water.

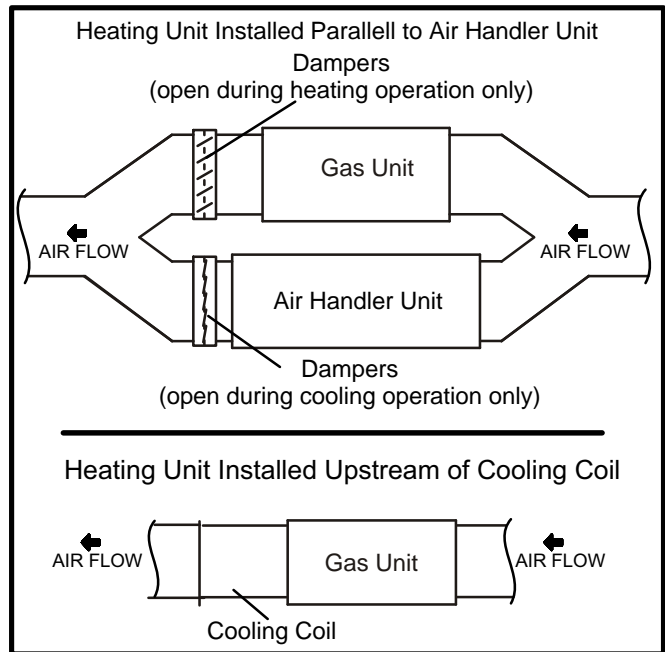
### Installed in Combination with a Cooling Coil

When this furnace is used with cooling coils (figure 3), it shall be installed in parallel with, or on the upstream side of, cooling coils to avoid condensation in the heating compartment. With a parallel flow arrangement, a damper (or other means to control the flow of air) must adequately prevent chilled air from entering the furnace. If the damper is manually operated, it must be equipped to prevent operation of either the heating or the cooling unit, unless it is in the full **HEAT** or **COOL** setting.

When installed, this furnace must be electrically grounded according to local codes. In addition, in the United States, installation must conform with the current National Electric Code, ANSI/NFPA No. 70. The National Electric Code (ANSI/NFPA No. 70) is available from the following address:

National Fire Protection Association  
1 Battery March Park  
Quincy, MA 02269

In Canada, all electrical wiring and grounding for the unit must be installed according to the current regulations of the Canadian Electrical Code Part I (CSA Standard C22.1) and/or local codes.



**FIGURE 3**

**NOTE** - This furnace is designed for a minimum continuous return air temperature of 60°F (16°C) or an intermittent operation down to 55°F (13°C) dry bulb for cases where a night setback thermostat is used. Return air temperature must not exceed 85°F (29°C) dry bulb.

The ML193UH furnace may be installed in alcoves, closets, attics, basements, garages, crawl spaces and utility rooms in the upflow or horizontal position.

This furnace design has **not** been CSA certified for installation in mobile homes, recreational vehicles, or outdoors.

### Use of Furnace as Construction Heater

Lennox does not recommend the use of ML193UH units as a construction heater during any phase of construction. Very low return air temperatures, harmful vapors and operation of the unit with clogged or misplaced filters will damage the unit.

ML193UH units may be used for heating of buildings or structures under construction, if the following conditions are met:

- The vent system must be permanently installed per these installation instructions.
- A room thermostat must control the furnace. The use of fixed jumpers that will provide continuous heating is not allowed.
- The return air duct must be provided and sealed to the furnace.
- Return air temperature range between 60°F (16°C) and 80°F (27°C) must be maintained.
- Air filters must be installed in the system and must be maintained during construction.

- Air filters must be replaced upon construction completion.
- The input rate and temperature rise must be set per the furnace rating plate.
- One hundred percent (100%) outdoor air must be provided for combustion air requirements during construction. Temporary ducting may supply outdoor air to the furnace. Do not connect duct directly to the furnace. Size the temporary duct following these instructions in section for Combustion, Dilution and Ventilation Air in a confined space with air from outside.
- The furnace heat exchanger, components, duct system, air filters and evaporator coils must be thoroughly cleaned following final construction clean-up.
- All furnace operating conditions (including ignition, input rate, temperature rise and venting) must be verified according to these installation instructions.
- The "A" coil drain pan is high quality engineering polymer with a maximum service temperature of 500° F. However, adequate space must be provided between the drain pan and the furnace heat exchanger. At least 2" space is required for sectionalized heat exchanger and 4" for drum-type or oil-fired furnace exchanger. Closer spacing may damage the drain pan and cause leaking.

## General

These instructions are intended as a general guide and do not supersede local codes in any way. Consult authorities having jurisdiction before installation.

In addition to the requirements outlined previously, the following general recommendations must be considered when installing a ML193UH furnace:

- Place the furnace as close to the center of the air distribution system as possible. The furnace should also be located close to the vent termination point.
- When the furnace is installed in non-direct vent applications, do not install the furnace where drafts might blow directly into it. This could cause improper combustion and unsafe operation.
- When the furnace is installed in non-direct vent applications, do not block the furnace combustion air opening with clothing, boxes, doors, etc. Air is needed for proper combustion and safe unit operation.
- When the furnace is installed in an attic or other insulated space, keep insulation away from the furnace.
- When the furnace is installed in an unconditioned space, consider provisions required to prevent freezing of condensate drain system.

## ⚠ CAUTION

**ML193UH unit should not be installed in areas normally subject to freezing temperatures.**

## ⚠ WARNING

**Product contains fiberglass wool.**

**Disturbing the insulation in this product during installation, maintenance, or repair will expose you to fiberglass wool. Breathing this may cause lung cancer. (Fiberglass wool is known to the State of California to cause cancer.)**

**Fiberglass wool may also cause respiratory, skin, and eye irritation.**

**To reduce exposure to this substance or for further information, consult material safety data sheets available from address shown below, or contact your supervisor.**

**Lennox Industries Inc.  
P.O. Box 799900  
Dallas, TX 75379-9900**

## ⚠ WARNING

**Insufficient combustion air can cause headaches, nausea, dizziness or asphyxiation. It will also cause excess water in the heat exchanger resulting in rusting and premature heat exchanger failure. Excessive exposure to contaminated combustion air will result in safety and performance related problems. Avoid exposure to the following substances in the combustion air supply:**

**Permanent wave solutions  
Chlorinated waxes and cleaners  
Chlorine base swimming pool chemicals  
Water softening chemicals  
De-icing salts or chemicals  
Carbon tetrachloride  
Halogen type refrigerants  
Cleaning solvents (such as perchloroethylene)  
Printing inks, paint removers, varnishes, etc.  
Hydrochloric acid  
Cements and glues  
Antistatic fabric softeners for clothes dryers  
Masonry acid washing materials**

## Combustion, Dilution & Ventilation Air

**If the ML193UH is installed as a Non-Direct Vent Furnace, follow the guidelines in this section.**

**NOTE - In Non-Direct Vent installations, combustion air is taken from indoors or ventilated attic or crawlspace and flue gases are discharged out-doors.**

In the past, there was no problem in bringing in sufficient outdoor air for combustion. Infiltration provided all the air that was needed. In today's homes, tight construction practices make it necessary to bring in air from outside for combustion. Take into account that exhaust fans, appliance vents, chimneys, and fireplaces force additional air that could be used for combustion out of the house. Unless outside air is brought into the house for combustion, negative pressure (outside pressure is greater than inside pressure)

will build to the point that a downdraft can occur in the furnace vent pipe or chimney. As a result, combustion gases enter the living space creating a potentially dangerous situation.

In the absence of local codes concerning air for combustion and ventilation, use the guidelines and procedures in this section to install ML193UH furnaces to ensure efficient and safe operation. You must consider combustion air needs and requirements for exhaust vents and gas piping. A portion of this information has been reprinted with permission from the National Fuel Gas Code (ANSI-Z223.1/NFPA 54). This reprinted material is not the complete and official position of the ANSI on the referenced subject, which is represented only by the standard in its entirety.

In Canada, refer to the CSA B149 installation codes.

## ⚠ CAUTION

**Do not install the furnace in a corrosive or contaminated atmosphere. Meet all combustion and ventilation air requirements, as well as all local codes.**

All gas-fired appliances require air for the combustion process. If sufficient combustion air is not available, the furnace or other appliance will operate inefficiently and unsafely. Enough air must be provided to meet the needs of all fuel-burning appliances and appliances such as exhaust fans which force air out of the house. When fireplaces, exhaust fans, or clothes dryers are used at the same time as the furnace, much more air is required to ensure proper combustion and to prevent a downdraft. Insufficient air causes incomplete combustion which can result in carbon monoxide.

In addition to providing combustion air, fresh outdoor air dilutes contaminants in the indoor air. These contaminants may include bleaches, adhesives, detergents, solvents and other contaminants which can corrode furnace components.

The requirements for providing air for combustion and ventilation depend largely on whether the furnace is installed in an unconfined or a confined space.

### Unconfined Space

An unconfined space is an area such as a basement or large equipment room with a volume greater than 50 cubic feet (1.42 m<sup>3</sup>) per 1,000 Btu (.29 kW) per hour of the combined input rating of all appliances installed in that space. This space also includes adjacent rooms which are not separated by a door. Though an area may appear to be unconfined, it might be necessary to bring in outdoor air for combustion if the structure does not provide enough air by

infiltration. If the furnace is located in a building of tight construction with weather stripping and caulking around the windows and doors, follow the procedures in the Air from Outside section.

### Confined Space

A confined space is an area with a volume less than 50 cubic feet (1.42 m<sup>3</sup>) per 1,000 Btu (.29 kW) per hour of the combined input rating of all appliances installed in that space. This definition includes furnace closets or small equipment rooms.

When the furnace is installed so that supply ducts carry air circulated by the furnace to areas outside the space containing the furnace, the return air **must be** handled by ducts which are sealed to the furnace casing and which terminate outside the space containing the furnace. This is especially important when the furnace is mounted on a platform in a confined space such as a closet or small equipment room. Even a small leak around the base of the unit at the platform or at the return air duct connection can cause a potentially dangerous negative pressure condition. Air for combustion and ventilation can be brought into the confined space either from inside the building or from outside.

### Air from Inside

If the confined space that houses the furnace adjoins a space categorized as unconfined, air can be brought in by providing two permanent openings between the two spaces. Each opening must have a minimum free area of 1 square inch (645 mm<sup>2</sup>) per 1,000 Btu (.29 kW) per hour of total input rating of all gas-fired equipment in the confined space. Each opening must be at least 100 square inches (64516 mm<sup>2</sup>). One opening shall be within 12 inches (305 mm) of the top of the enclosure and one opening within 12 inches (305 mm) of the bottom. See figure 4.

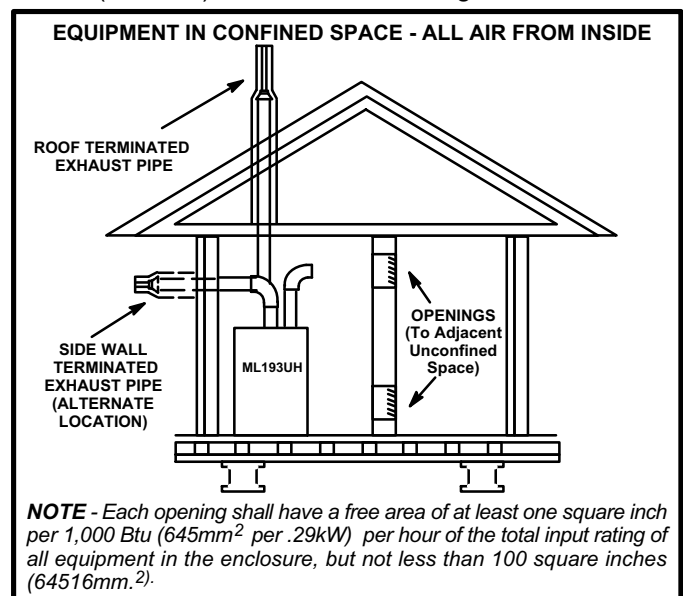
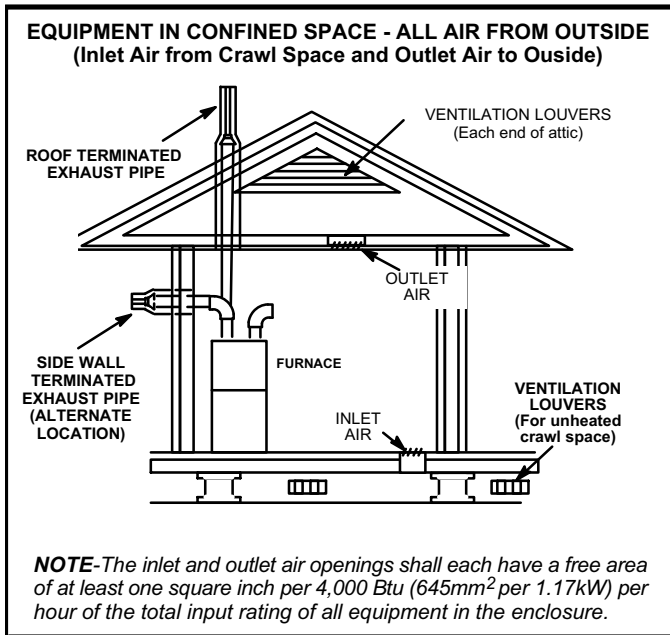


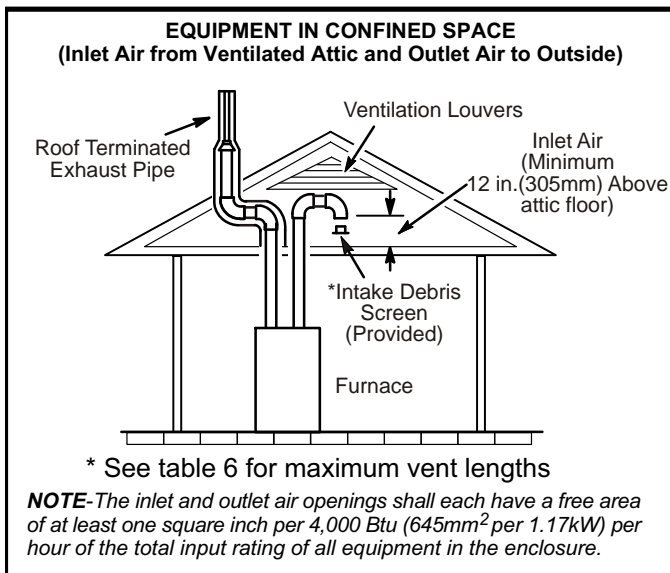
FIGURE 4

**Air from Outside**

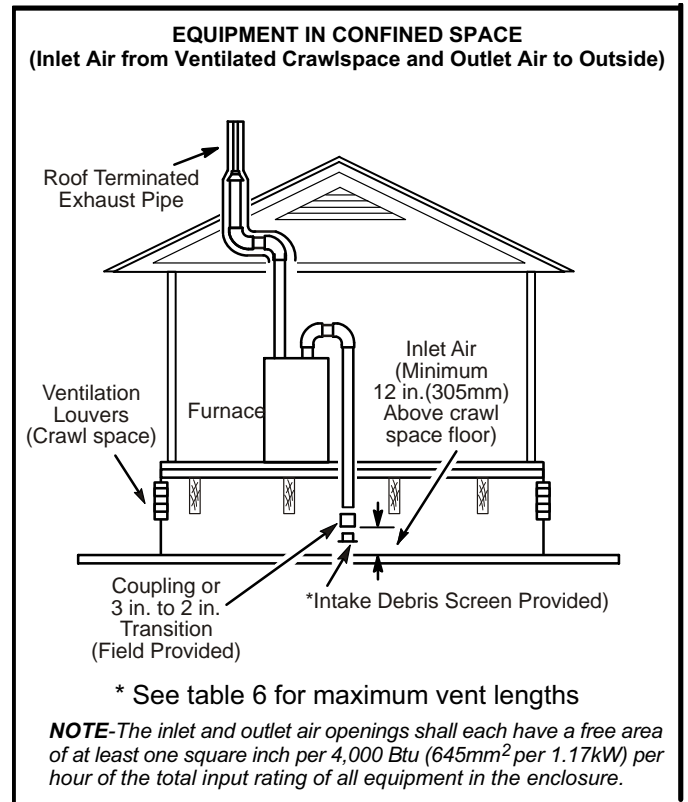
If air from outside is brought in for combustion and ventilation, the confined space shall be provided with two permanent openings. One opening shall be within 12" (305mm) of the top of the enclosure and one within 12" (305mm) of the bottom. These openings must communicate directly or by ducts with the outdoors or spaces (crawl or attic) that freely communicate with the outdoors or indirectly through vertical ducts. Each opening shall have a minimum free area of 1 square inch per 4,000 Btu (645mm<sup>2</sup> per 1.17kW) per hour of total input rating of all equipment in the enclosure. When communicating with the outdoors through horizontal ducts, each opening shall have a minimum free area of 1 square inch per 2,000 Btu (645mm<sup>2</sup> per .59kW) per total input rating of all equipment in the enclosure (See figure 5). It is also permissible to bring in air for combustion from a ventilated attic (figure 6) or ventilated crawl space (figure 7).



**FIGURE 5**



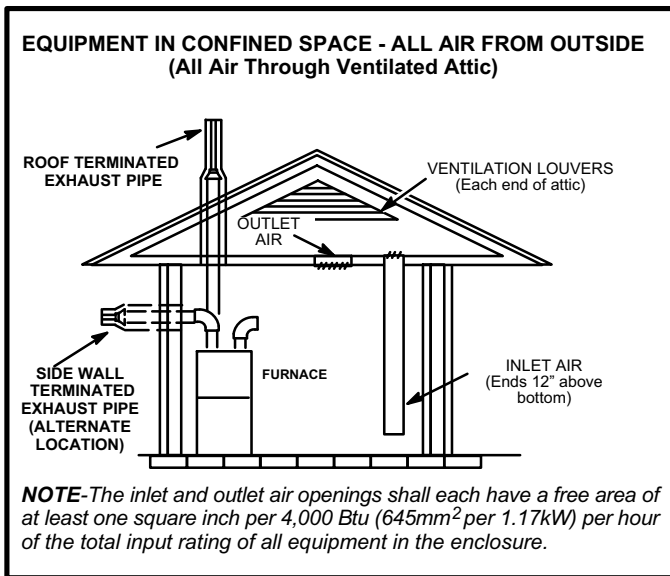
**FIGURE 6**



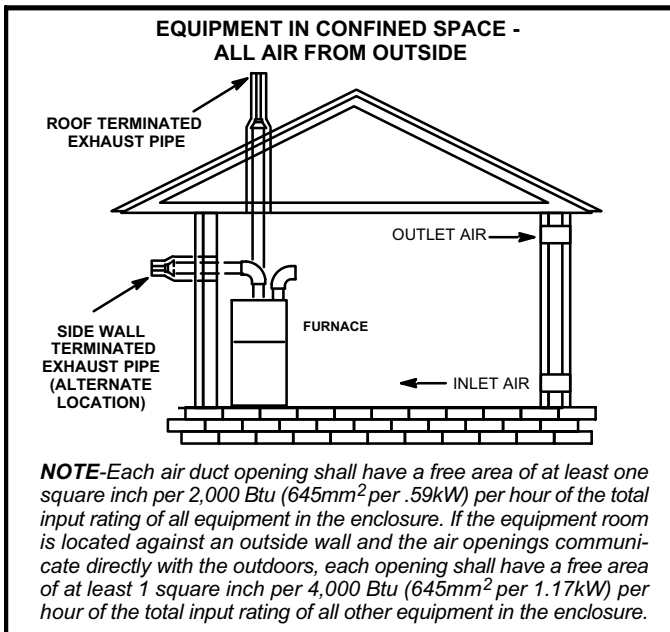
**FIGURE 7**

If air from outside is brought in for combustion and ventilation, the confined space must have two permanent openings. One opening shall be within 12 inches (305 mm) of the top of the enclosure and one opening within 12 inches (305 mm) of the bottom. These openings must communicate directly or by ducts with the outdoors or spaces (crawl or attic) that freely communicate with the outdoors or indirectly through vertical ducts. Each opening shall have a minimum free area of 1 square inch (645 mm<sup>2</sup>) per 4,000 Btu (1.17 kW) per hour of total input rating of all equipment in the enclosure. See figures 5 and 8. When communicating with the outdoors through horizontal ducts, each opening shall have a minimum free area of 1 square inch (645 mm<sup>2</sup>) per 2,000 Btu (.56 kW) per total input rating of all equipment in the enclosure. See figure 9.

When ducts are used, they shall be of the same cross-sectional area as the free area of the openings to which they connect. The minimum dimension of rectangular air ducts shall be no less than 3 inches (75 mm). In calculating free area, the blocking effect of louvers, grilles, or screens must be considered. If the design and free area of protective covering is not known for calculating the size opening required, it may be assumed that wood louvers will have 20 to 25 percent free area and metal louvers and grilles will have 60 to 75 percent free area. Louvers and grilles must be fixed in the open position or interlocked with the equipment so that they are opened automatically during equipment operation.



**FIGURE 8**

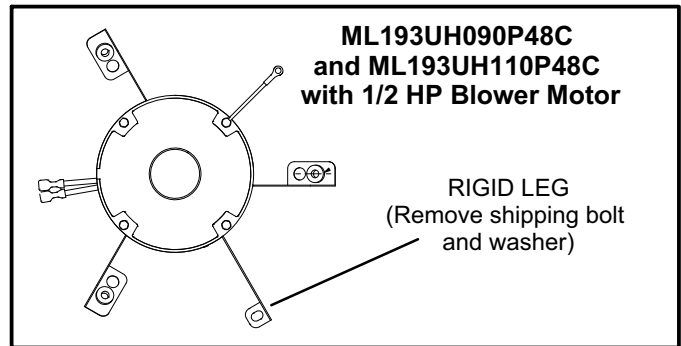


**FIGURE 9**

**Shipping Bolt Removal**

Units with 1/2 hp blower motor are equipped with three flexible legs and one rigid leg. The rigid leg is equipped with a shipping bolt and a flat white plastic washer (rather than the rubber mounting grommet used with a flexible mounting

leg). See figure 10. The bolt and washer must be removed before the furnace is placed into operation. After the bolt and washer have been removed, the rigid leg will not touch the blower housing.



**FIGURE 10**

**Installation - Setting Equipment**

**⚠ WARNING**  
Do not connect the return air duct to the back of the furnace. Doing so will adversely affect the operation of the safety control devices, which could result in personal injury or death.

**⚠ WARNING**  
Blower access panel must be securely in place when blower and burners are operating. Gas fumes, which could contain carbon monoxide, can be drawn into living space resulting in personal injury or death.

**Upflow Applications**

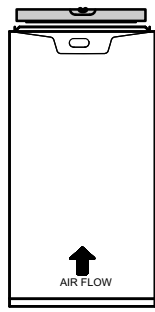
The ML193UH gas furnace can be installed as shipped in the upflow position. Refer to figure 12 for clearances. Select a location that allows for the required clearances that are listed on the unit nameplate. Also consider gas supply connections, electrical supply, vent connection, condensate trap and drain connections, and installation and service clearances [24 inches (610 mm) at unit front]. The unit must be level from side to side. Unit may be positioned from level to 1/2" toward the front to aid in draining. See figure 11.

Allow for clearances to combustible materials as indicated on the unit nameplate.

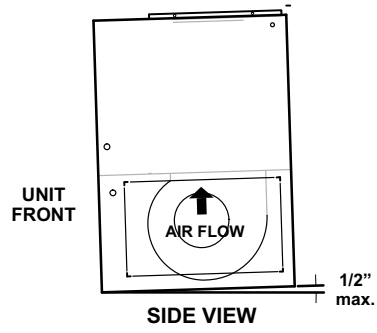


**SETTING EQUIPMENT**

**UPFLOW APPLICATION**

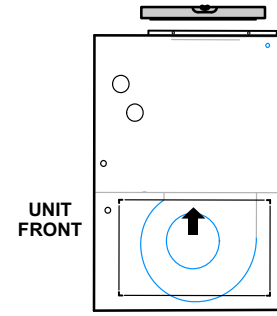


**FRONT VIEW**



**UNIT FRONT**

**SIDE VIEW**

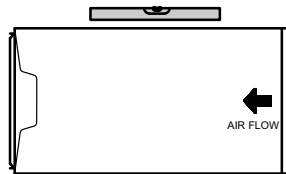


**UNIT FRONT**

**SIDE VIEW**

---

**HORIZONTAL APPLICATION**



**FRONT VIEW**



**UNIT FRONT**

**END VIEW**

Unit must be level side-to-side. Unit may be positioned from level to 1/2" toward the front to aid in draining.

**FIGURE 11**

## ⚠ WARNING

Improper installation of the furnace can result in personal injury or death. Combustion and flue products must never be allowed to enter the return air system or air in the living space. Use sheet metal screws and joint tape to seal return air system to furnace. In platform installations with furnace return, the furnace should be sealed airtight to the return air plenum. A door must never be used as a portion of the return air duct system. The base must provide a stable support and an airtight seal to the furnace. Allow absolutely no sagging, cracks, gaps, etc. For no reason should return and supply air duct systems ever be connected to or from other heating devices such as a fireplace or stove, etc. Fire, explosion, carbon monoxide poisoning, personal injury and/or property damage could result.

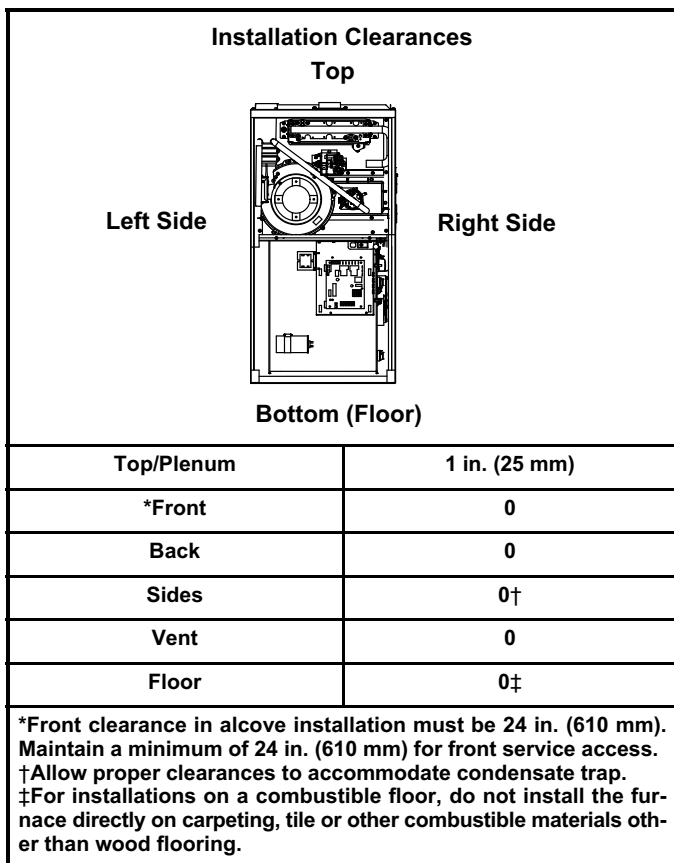


FIGURE 12

## Return Air Guidelines

Return air can be brought in through the bottom or either side of the furnace installed in an upflow application. If the furnace is installed on a platform with bottom return, make an airtight seal between the bottom of the furnace and the platform to ensure that the furnace operates properly and safely. The furnace is equipped with a removable bottom panel to facilitate installation.

Markings are provided on both sides of the furnace cabinet for installations that require side return air. Cut the furnace cabinet at the maximum dimensions shown on page 2.

Refer to *Engineering Handbook* for additional information.

**ML193UH applications which include side return air and a condensate trap installed on the same side of the cabinet (trap can be installed remotely within 5 ft.) require either a return air base or field-fabricated transition to accommodate an optional IAQ accessory taller than 14.5". See figure 13.**

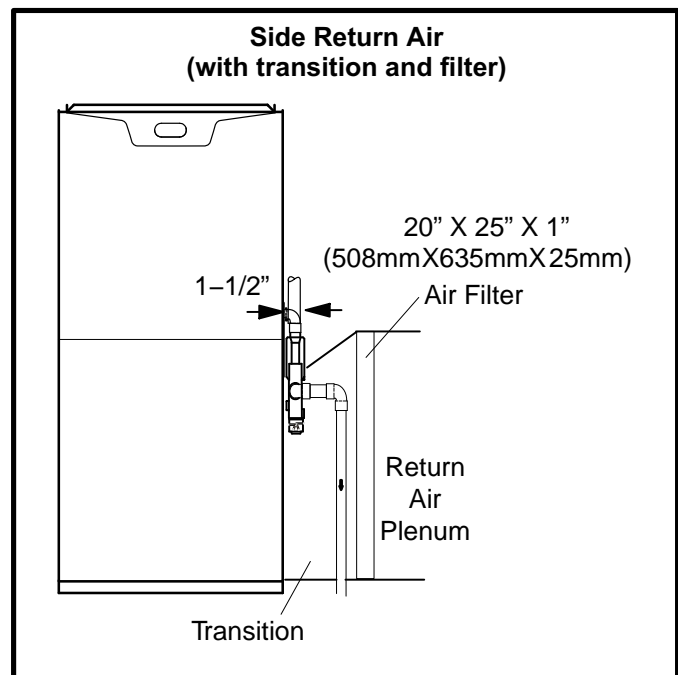


FIGURE 13

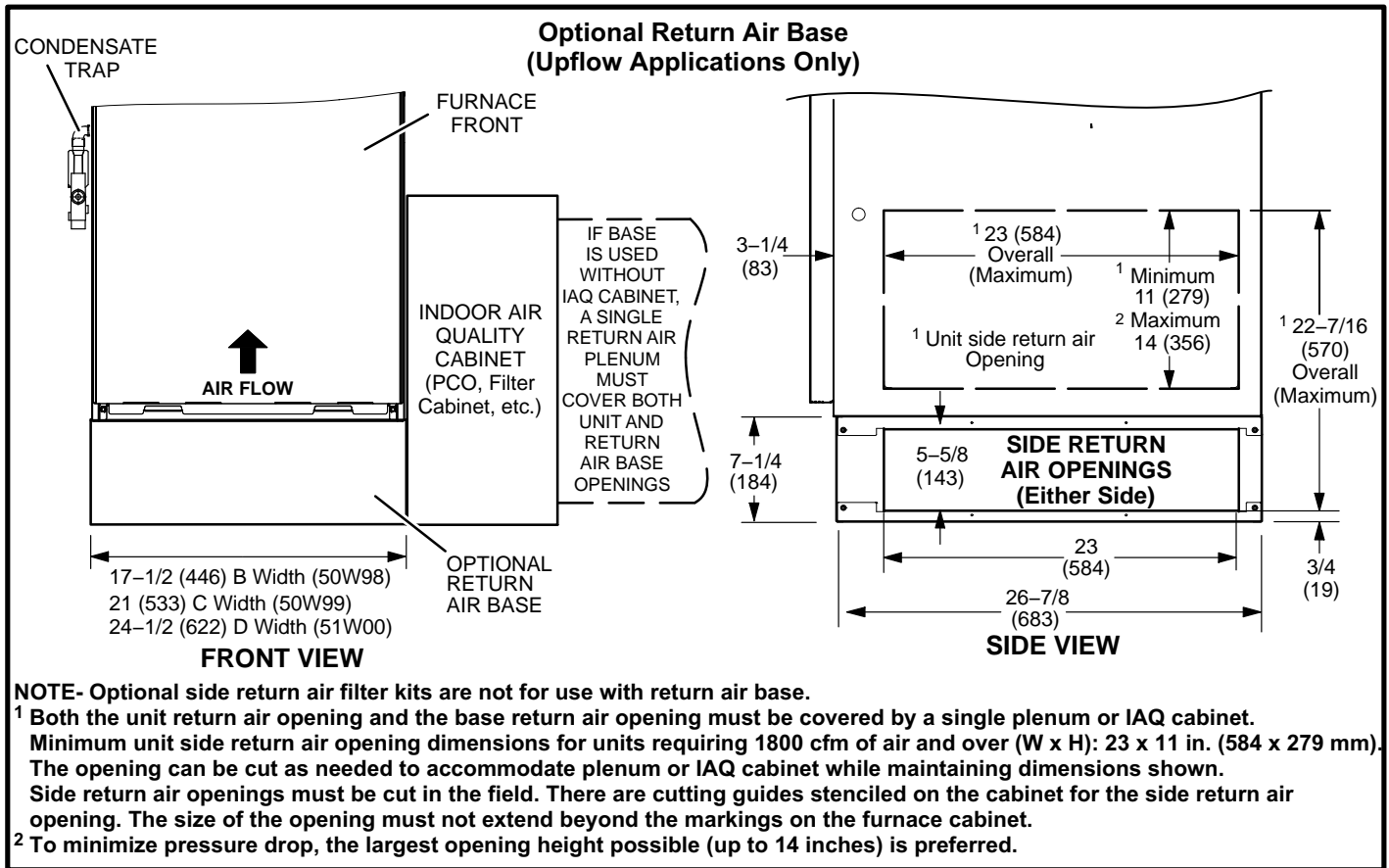


FIGURE 14

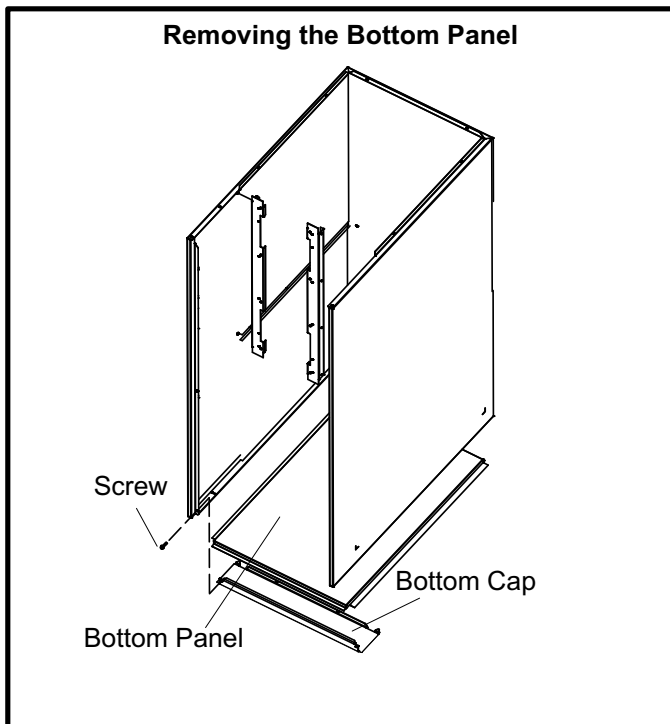


FIGURE 15

### Removing the Bottom Panel

Remove the two screws that secure the bottom cap to the furnace. Pivot the bottom cap down to release the bottom panel. Once the bottom panel has been removed, reinstall the bottom cap. See figure 15.

### Horizontal Applications

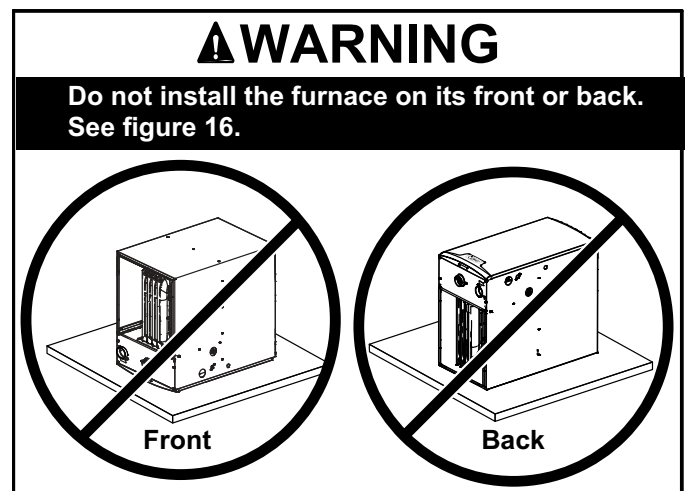


FIGURE 16

The ML193UH furnace can be installed in horizontal applications with either right- or left-hand air discharge. Refer to figure 17 for clearances in horizontal applications.

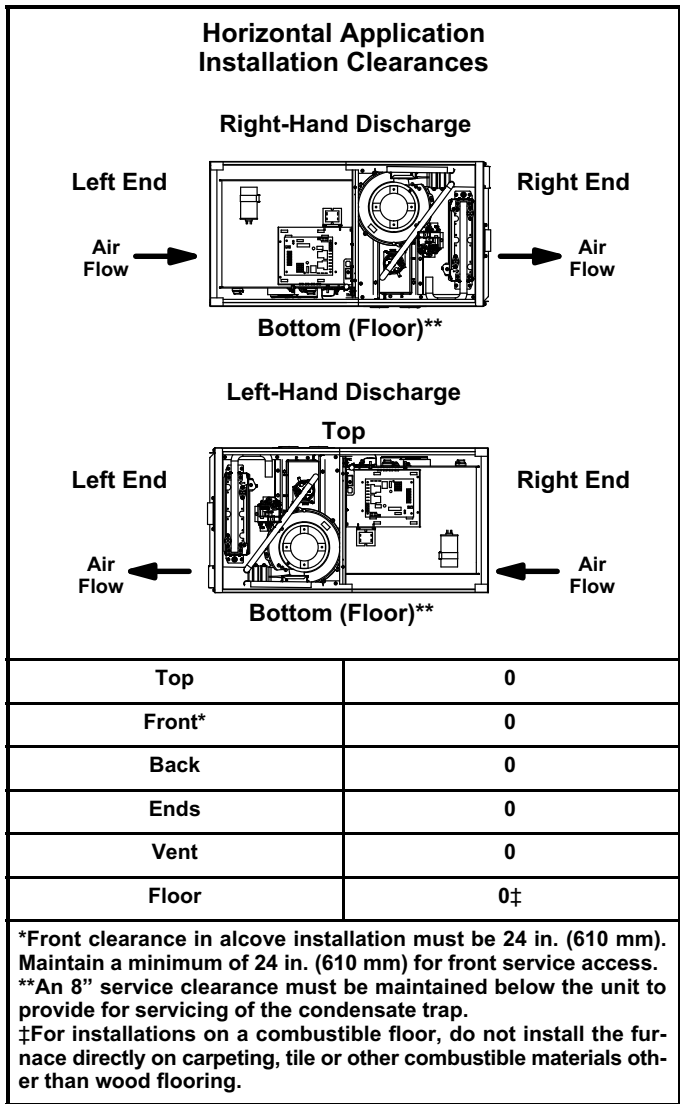


FIGURE 17

**Suspended Installation of Horizontal Unit**

This furnace may be installed in either an attic or a crawlspace. Either suspend the furnace from roof rafters or floor joists, as shown in figure 18, or install the furnace on a platform, as shown in figure 19. A horizontal suspension kit (51W10) may be ordered from Lennox or use equivalent. **NOTE - Heavy-gauge sheet metal straps may be used to suspend the unit from roof rafters or ceiling joists. When straps are used to suspend the unit in this way, support must be provided for both the ends. The straps must not interfere with the plenum or exhaust piping installation. Cooling coils and supply and return air plenums must be supported separately.**

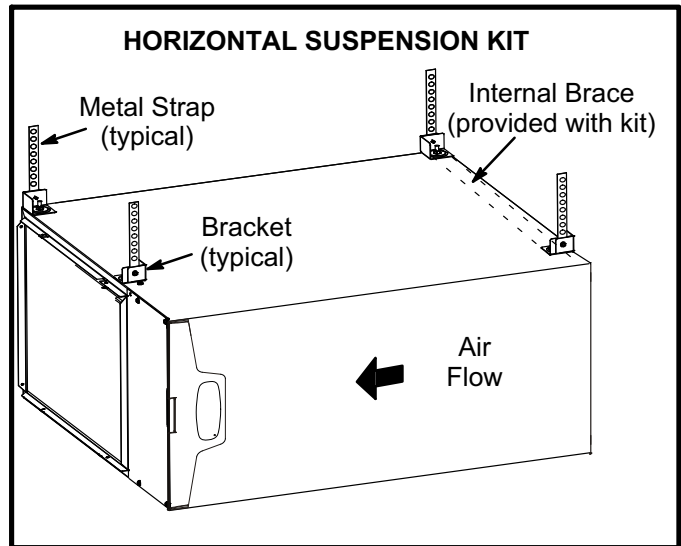


FIGURE 18

**NOTE -** When the furnace is installed on a platform or with the horizontal suspension kit in a crawlspace, it must be elevated enough to avoid water damage, accommodate drain trap and to allow the evaporator coil to drain.

**Platform Installation of Horizontal Unit**

- 1 - Select location for unit keeping in mind service and other necessary clearances. See figure 17.
- 2 - Construct a raised wooden frame and cover frame with a plywood sheet. If unit is installed above finished space, fabricate an auxiliary drain pan to be installed under unit. Set unit in drain pan as shown in figure 19. Leave 8 inches for service clearance below unit for condensate trap.
- 3 - Provide a service platform in front of unit. When installing the unit in a crawl space, a proper support platform may be created using cement blocks.
- 4 - Route auxiliary drain line so that water draining from this outlet will be easily noticed by the homeowner.
- 5 - If necessary, run the condensate line into a condensate pump to meet drain line slope requirements. The pump must be rated for use with condensing furnaces. Protect the condensate discharge line from the pump to the outside to avoid freezing.
- 6 - Continue with exhaust, condensate and intake piping installation according to instructions.

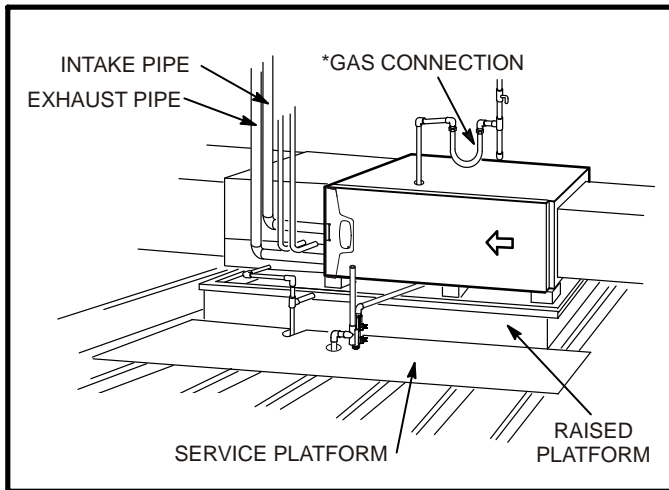


FIGURE 19

### Return Air -- Horizontal Applications

Return air may be brought in only through the end of a furnace installed in the horizontal position. The furnace is equipped with a removable bottom panel to facilitate installation. See figure 15.

### Filters

This unit is not equipped with a filter or rack. A field-provided high velocity rated filter is required for the unit to operate properly. Table 1 lists recommended filter sizes.

A filter must be in place whenever the unit is operating.

## ⚠ IMPORTANT

**If a high-efficiency filter is being installed as part of this system to ensure better indoor air quality, the filter must be properly sized. High-efficiency filters have a higher static pressure drop than standard-efficiency glass/foam filters. If the pressure drop is too great, system capacity and performance may be reduced. The pressure drop may also cause the limit to trip more frequently during the winter and the indoor coil to freeze in the summer, resulting in an increase in the number of service calls.**

**Before using any filter with this system, check the specifications provided by the filter manufacturer against the data given in the appropriate Lennox Product Specifications bulletin. Additional information is provided in Service and Application Note ACC-00-2 (August 2000).**

TABLE 1

Furnace Cabinet Width	Filter Size	
	Side Return	Bottom Return
17-1/2"	16 X 25 X 1 (1)	16 X 25 X 1 (1)
21"	16 X 25 X 1 (1)	20 X 25 X 1 (1)
24-1/2"	16 X 25 X 1 (2)	24 X 25 X 1 (1)

### Duct System

Use industry-approved standards to size and install the supply and return air duct system. Refer to ACCA Manual D. This will result in a quiet and low-static system that has uniform air distribution.

**NOTE** - This furnace is not certified for operation in heating mode (indoor blower operating at selected heating speed) with an external static pressure which exceeds 0.5 inches w.c. Operation at these conditions may result in improper limit operation.

### Supply Air Plenum

If the furnace is installed without a cooling coil, a removable access panel should be installed in the supply air duct. The access panel should be large enough to permit inspection of the heat exchanger. The furnace access panel must always be in place when the furnace is operating and it must not allow leaks.

### Return Air Plenum

**NOTE** - Return air must not be drawn from a room where this furnace, or any other gas-fueled appliance (i.e., water heater), or carbon monoxide-producing device (i.e., wood fireplace) is installed.

When return air is drawn from a room, a negative pressure is created in the room. If a gas appliance is operating in a room with negative pressure, the flue products can be pulled back down the vent pipe and into the room. This reverse flow of the flue gas may result in incomplete combustion and the formation of carbon monoxide gas. This raw gas or toxic fumes might then be distributed throughout the house by the furnace duct system.

Return air can be brought in through the bottom or either side of the furnace (return air brought into either side furnace allowed in upflow applications only). If a furnace with bottom return air is installed on a platform, make an airtight seal between the bottom of the furnace and the platform to ensure that the unit operates properly and safely. Use fiberglass sealing strips, caulking, or equivalent sealing method between the plenum and the furnace cabinet to ensure a tight seal. If a filter is installed, size the return air duct to fit the filter frame.

### Pipe & Fittings Specifications

All pipe, fittings, primer and solvent cement must conform with American National Standard Institute and the American Society for Testing and Materials (ANSI/ASTM) standards. The solvent shall be free flowing and contain no lumps, undissolved particles or any foreign matter that adversely affects the joint strength or chemical resistance of the cement. The cement shall show no gelation, stratification, or separation that cannot be removed by stirring. Refer to the table 2 below for approved piping and fitting materials.

## ⚠ CAUTION

Solvent cements for plastic pipe are flammable liquids and should be kept away from all sources of ignition. Do not use excessive amounts of solvent cement when making joints. Good ventilation should be maintained to reduce fire hazard and to minimize breathing of solvent vapors. Avoid contact of cement with skin and eyes.

**TABLE 2  
PIPING AND FITTINGS SPECIFICATIONS**

Schedule 40 PVC (Pipe)	D1785
Schedule 40 PVC (Cellular Core Pipe)	F891
Schedule 40 PVC (Fittings)	D2466
Schedule 40 CPVC (Pipe)	F441
Schedule 40 CPVC (Fittings)	F438
SDR-21 PVC or SDR-26 PVC (Pipe)	D2241
SDR-21 CPVC or SDR-26 CPVC (Pipe)	F442
Schedule 40 ABS Cellular Core DWV (Pipe)	F628
Schedule 40 ABS (Pipe)	D1527
Schedule 40 ABS (Fittings)	D2468
ABS-DWV (Drain Waste & Vent) (Pipe & Fittings)	D2661
PVC-DWV (Drain Waste & Vent) Pipe & Fittings)	D2665
<b>PRIMER &amp; SOLVENT CEMENT</b>	<b>ASTM SPECIFICATION</b>
PVC & CPVC Primer	F656
PVC Solvent Cement	D2564
CPVC Solvent Cement	F493
ABS Solvent Cement	D2235
PVC/CPVC/ABS All Purpose Cement For Fittings & Pipe of the same material	D2564, D2235, F493
ABS to PVC or CPVC Transition Solvent Cement	D3138
<b>CANADA PIPE &amp; FITTING &amp; SOLVENT CEMENT</b>	<b>MARKING</b>
PVC & CPVC Pipe and Fittings	ULCS636
PVC & CPVC Solvent Cement	
ABS to PVC or CPVC Transition Cement	

## ⚠ IMPORTANT

ML193UH exhaust and intake connections are made of PVC. Use PVC primer and solvent cement when using PVC vent pipe. When using ABS vent pipe, use transitional solvent cement to make connections to the PVC fittings in the unit.

Use PVC primer and solvent cement or ABS solvent cement meeting ASTM specifications, refer to Table 2. As an alternate, use all purpose cement, to bond ABS, PVC, or CPVC pipe when using fittings and pipe made of the same materials. Use transition solvent cement when bonding ABS to either PVC or CPVC.

Low temperature solvent cement is recommended during cooler weather. Metal or plastic strapping may be used for vent pipe hangers. Uniformly apply a liberal coat of PVC primer for PVC or use a clean dry cloth for ABS to clean inside socket surface of fitting and male end of pipe to depth of fitting socket.

***Canadian Applications Only** - Pipe, fittings, primer and solvent cement used to vent (exhaust) this appliance must be certified to ULC S636 and supplied by a single manufacturer as part of an approved vent (exhaust) system. In addition, the first three feet of vent pipe from the furnace flue collar must be accessible for inspection.*

**TABLE 3  
OUTDOOR TERMINATION USAGE\***

Input Size	Vent Pipe Dia. in.	STANDARD					CONCENTRIC		
		Flush-Mount Kit	Wall Kit		Wall Ring Kit	Field Fabricated	1-1/2 inch	2 inch	3 inch
			2 inch	3 inch	2 inch				
		51W11 (US) 51W12 (CA)	22G44 (US) 430G28 (CA)	44J40 (US) 481J20 (CA)	15F74		71M80 (US) 444W92 (CA)	69M29 (US) 444W92 (CA)	60L46 (US) 444W93 (CA)
045	2	<sup>3</sup> YES	YES	<sup>1</sup> YES	<sup>1</sup> YES	<sup>5</sup> YES	<sup>2</sup> YES		
	2-1/2	<sup>3</sup> YES	YES	<sup>1</sup> YES	<sup>1</sup> YES	<sup>5</sup> YES	<sup>2</sup> YES		
	3	<sup>3</sup> YES	YES	<sup>1</sup> YES	<sup>1</sup> YES	<sup>5</sup> YES	<sup>2</sup> YES		
070	2	<sup>3</sup> YES	YES	<sup>1</sup> YES	<sup>1</sup> YES	<sup>5</sup> YES	<sup>2</sup> YES		
	2-1/2	<sup>3</sup> YES	YES	<sup>1</sup> YES	<sup>1</sup> YES	<sup>5</sup> YES	<sup>2</sup> YES		
	3	<sup>3</sup> YES	YES	<sup>1</sup> YES	<sup>1</sup> YES	<sup>5</sup> YES	<sup>2</sup> YES		
090	2	<sup>3</sup> YES		YES	YES	<sup>5</sup> YES		YES	YES
	2-1/2	<sup>3</sup> YES		YES	YES	<sup>5</sup> YES		YES	YES
	3	<sup>3</sup> YES		YES	YES	<sup>5</sup> YES		YES	YES
110	2	YES		YES	YES	<sup>5</sup> YES		YES	YES
	2-1/2	YES		YES		<sup>5</sup> YES		YES	YES
	3	YES		YES		<sup>5</sup> YES		YES	YES
135	3	YES		YES		<sup>5</sup> YES		YES	

NOTE - Standard Terminations do not include any vent pipe or elbows external to the structure. Any vent pipe or elbows external to the structure must be included in total vent length calculations. See vent length tables.

\* Kits must be properly installed according to kit instructions.

<sup>1</sup>Requires field-provided outdoor 1-1/2" exhaust accelerator.

<sup>2</sup>Concentric kits 71M80 and 44W92 include 1-1/2" outdoor accelerator, when used with 045 and 070 input models.

<sup>3</sup>Flush mount kits 51W11 and 51W12 includes 1-1/2 in. outdoor exhaust accelerator, required when used with 045, 070 and 090 input models.

<sup>4</sup>Termination kits 30G28, 44W92, 4493 and 81J20 are certified to ULC S636 for use in Canada only.

<sup>5</sup>See table 8 for vent accelerator requirements.

### Joint Cementing Procedure

All cementing of joints should be done according to the specifications outlined in ASTM D 2855.

**NOTE** - A sheet metal screw may be used to secure the intake pipe to the connector, if desired. Use a drill or self tapping screw to make a pilot hole.

## DANGER

### DANGER OF EXPLOSION!

**Fumes from PVC glue may ignite during system check. Allow fumes to dissipate for at least 5 minutes before placing unit into operation.**

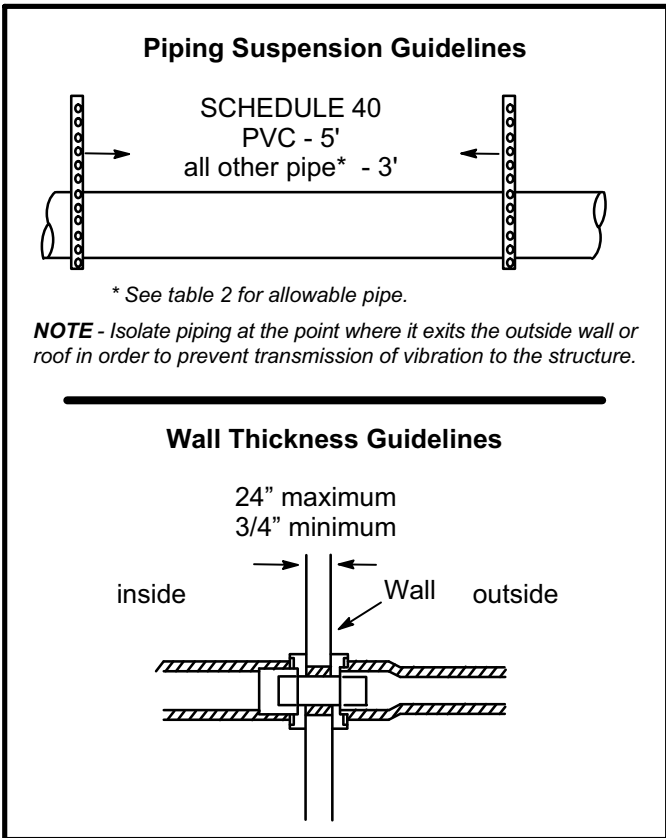
- 1 - Measure and cut vent pipe to desired length.
- 2 - Debur and chamfer end of pipe, removing any ridges or rough edges. If end is not chamfered, edge of pipe may remove cement from fitting socket and result in a leaking joint.
- 3 - Clean and dry surfaces to be joined.

- 4 - Test fit joint and mark depth of fitting on outside of pipe.
- 5 - Uniformly apply a liberal coat of PVC primer for PVC or use a clean dry cloth for ABS to clean inside socket surface of fitting and male end of pipe to depth of fitting socket.  
**NOTE** - Time is critical at this stage. Do not allow primer to dry before applying cement.
- 6 - Promptly apply solvent cement to end of pipe and inside socket surface of fitting. Cement should be applied lightly but uniformly to inside of socket. Take care to keep excess cement out of socket. Apply second coat to end of pipe.
- 7 - Immediately after applying last coat of cement to pipe, and while both inside socket surface and end of pipe are wet with cement, forcefully insert end of pipe into socket until it bottoms out. Turn PVC pipe 1/4 turn during assembly (but not after pipe is fully inserted) to distribute cement evenly. DO NOT turn ABS or cellular core pipe.

**NOTE** - Assembly should be completed within 20 seconds after last application of cement. Hammer blows should not be used when inserting pipe.

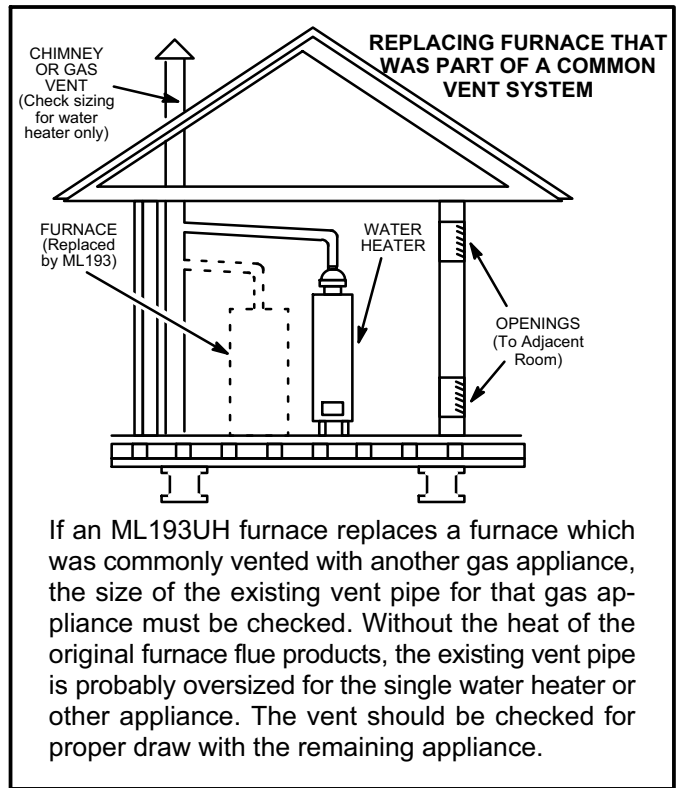
- 8 - After assembly, wipe excess cement from pipe at end of fitting socket. A properly made joint will show a bead around its entire perimeter. Any gaps may indicate an improper assembly due to insufficient solvent.
- 9 - Handle joints carefully until completely set.

**Venting Practices**



**FIGURE 20**

- 1 - In areas where piping penetrates joists or interior walls, hole must be large enough to allow clearance on all sides of pipe through center of hole using a hanger.
- 2 - When furnace is installed in a residence where unit is shut down for an extended period of time, such as a vacation home, make provisions for draining condensate collection trap and lines.



**FIGURE 21**

**Exhaust Piping (Figures 24 and 25)**

Route piping to outside of structure. Continue with installation following instructions given in piping termination section.

**⚠ CAUTION**

**Do not discharge exhaust into an existing stack or stack that also serves another gas appliance. If vertical discharge through an existing unused stack is required, insert PVC pipe inside the stack until the end is even with the top or outlet end of the metal stack.**

**⚠ CAUTION**

**The exhaust vent pipe operates under positive pressure and must be completely sealed to prevent leakage of combustion products into the living space.**



## Vent Piping Guidelines

The ML193UH can be installed as either a Non-Direct Vent or a Direct Vent gas central furnace.

**NOTE** - In Non-Direct Vent installations, combustion air is taken from indoors and flue gases are discharged outdoors. In Direct Vent installations, combustion air is taken from outdoors and flue gases are discharged outdoors.

**Intake and exhaust pipe sizing** -- Size pipe according to tables 4 and 5. Count all elbows inside and outside the home. Table 4 lists the *minimum* vent pipe lengths permitted. Table 5 lists the *maximum* pipe lengths permitted. Regardless of the diameter of pipe used, the standard roof and wall terminations described in section *Exhaust Piping Terminations* should be used. Exhaust vent termination pipe is sized to optimize the velocity of the exhaust gas as it exits the termination. Refer to table 8.

In some applications which permit the use of several different sizes of vent pipe, a combination vent pipe may be used. Contact Lennox' Application Department for assistance in sizing vent pipe in these applications.

**NOTE** - The exhaust collar on all models is sized to accommodate 2" Schedule 40 vent pipe. In horizontal applications, any transition to exhaust pipe larger than 2" must be made in vertical runs of the pipe. Therefore a 2" elbow must be added before the pipe is transitioned to any size larger than 2". This elbow must be added to the elbow count used to determine acceptable vent lengths. Contact the Application Department for more information concerning sizing of vent systems which include multiple pipe sizes.

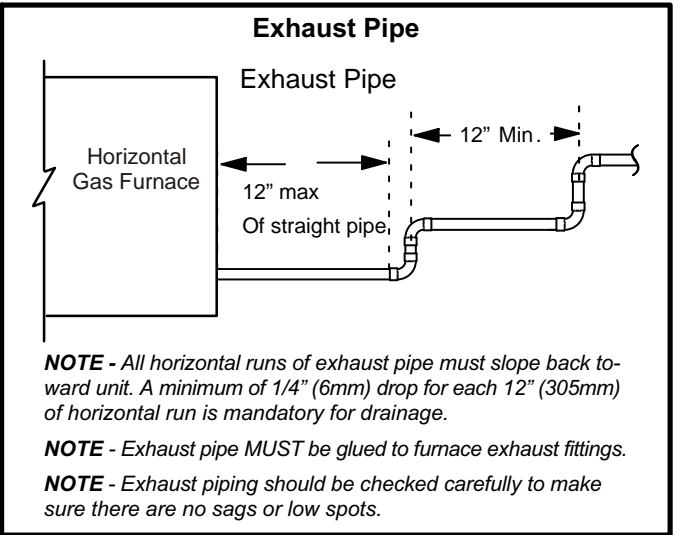


FIGURE 22

TABLE 4  
MINIMUM VENT PIPE LENGTHS

ML193UH MODEL	MIN. VENT LENGTH*
045, 070, 090, 110	15 ft. or 5 ft plus 2 elbows or 10 ft plus 1 elbow
135	

\*Any approved termination may be added to the minimum length listed.

Use the following steps to correctly size vent pipe diameter.

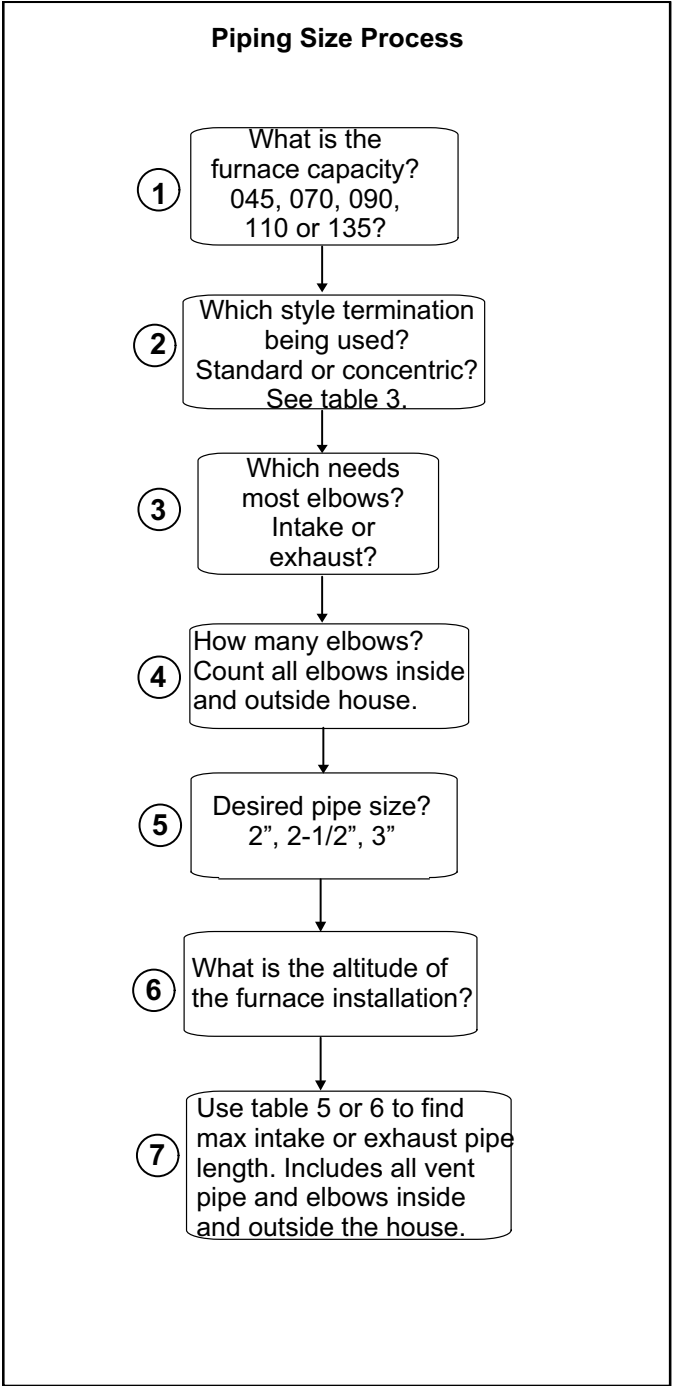


FIGURE 23

**⚠ IMPORTANT**

**Do not use screens or perforated metal in exhaust or intake terminations. Doing so will cause freeze-ups and may block the terminations.**

**TABLE 5**  
**Maximum Allowable Intake or Exhaust Vent Length in Feet**

NOTE - Size intake and exhaust pipe length separately. Values in table are for Intake OR Exhaust, not combined total. Both Intake and Exhaust must be same pipe size.

NOTE - Additional vent pipe and elbows used to terminate the vent pipe outside the structure must be included in the total vent length calculation.

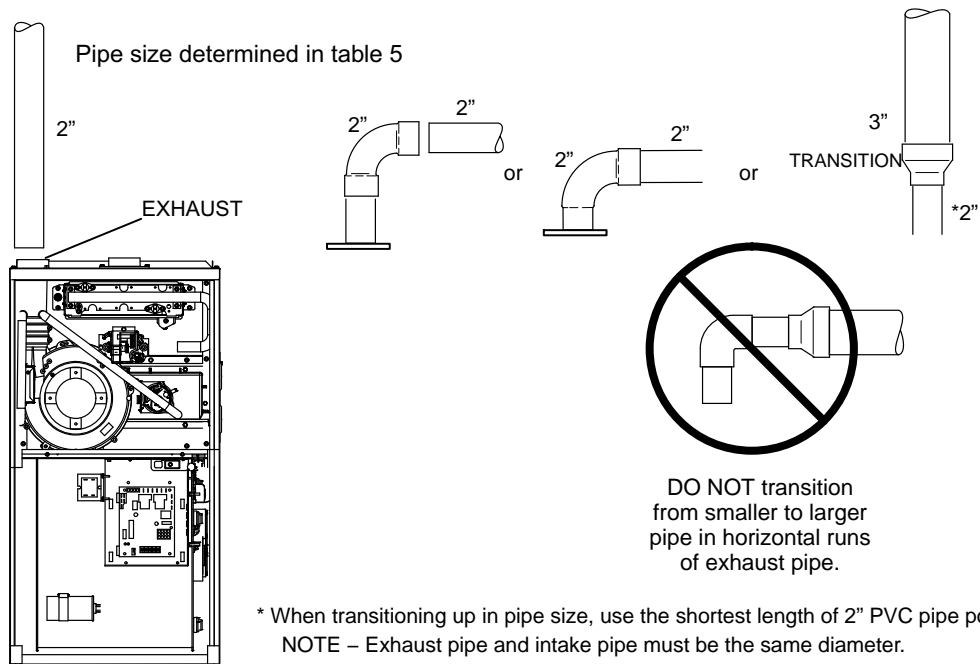
Standard Termination at Elevation 0 - 10,000															
Number Of 90° Elbows Used	2" Pipe					2-1/2" Pipe					3" Pipe				
	Model					Model					Model				
	045	070	090	110	135	045	070	090	110	135	045	070	090	110	135
1	81	66	44	24	n/a	115	100	68	43	n/a	137	137	118	118	114
2	76	61	39	19		110	95	63	38		132	132	113	113	109
3	71	56	34	14		105	90	58	33		127	127	108	108	104
4	66	51	29	n/a		100	85	53	28		122	122	103	103	99
5	61	46	24			95	80	48	23		117	117	98	98	94
6	56	41	19			90	75	43	18		112	112	93	93	89
7	51	36	14			85	70	38	13		107	107	88	88	84
8	46	31	n/a			80	65	33	n/a		102	102	83	83	79
9	41	26				75	60	28			97	97	78	78	74
10	36	21		70		55	23	92			92	73	73	69	
Concentric Termination Elevation 0 - 10,000															
Number Of 90° Elbows Used	2" Pipe					2-1/2" Pipe					3" Pipe				
	Model					Model					Model				
	045	070	090	110	135	045	070	090	110	135	045	070	090	110	135
1	73	58	42	22	n/a	105	90	64	39	n/a	121	121	114	114	105
2	68	53	37	17		100	85	59	34		116	116	109	109	100
3	63	48	32	12		95	80	54	29		111	111	104	104	95
4	58	43	27	n/a		90	75	49	24		106	106	99	99	90
5	53	38	22			85	70	44	19		101	101	94	94	85
6	48	33	17			80	65	39	14		96	96	89	89	80
7	43	28	12			75	60	34	n/a		91	91	84	84	75
8	38	23	n/a			70	55	29			86	86	79	79	70
9	33	18				65	50	24			81	81	74	74	65
10	28	13	60	45		19	76	76	69		69	60			

**TABLE 6**  
**Maximum Allowable Exhaust Vent Lengths With Furnace Installed in a Closet or Basement Using Ventilated Attic or Crawl Space For Intake Air in Feet**

NOTE - Additional vent pipe and elbows used to terminate the vent pipe outside the structure must be included in the total vent length calculation.

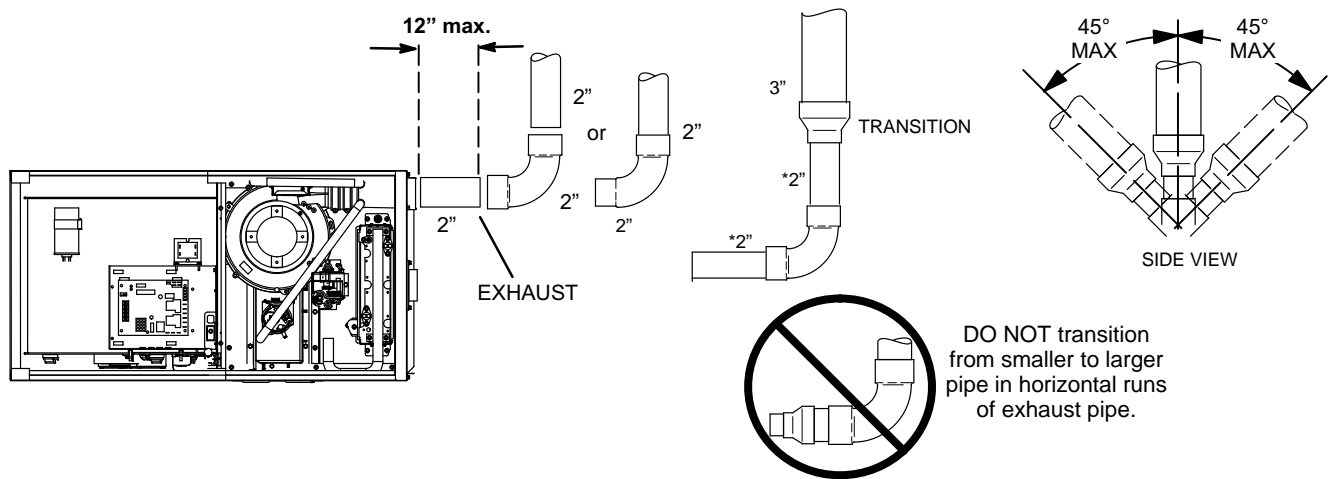
Standard Termination at Elevation 0 - 10,000															
Number Of 90° Elbows Used	2" Pipe					2-1/2" Pipe					3" Pipe				
	Model					Model					Model				
	045	070	090	110	135	045	070	090	110	135	045	070	090	110	135
1	71	56	34	14	n/a	100	95	53	28	n/a	117	117	98	98	94
2	66	51	29	9		95	80	48	23		112	112	93	93	89
3	61	46	24	4		90	75	43	18		107	107	88	88	84
4	56	41	19	n/a		85	70	38	13		102	102	83	83	79
5	51	36	14			80	65	33	8		97	97	78	78	74
6	46	31	9			75	60	28	3		92	92	73	73	69
7	41	26	4			70	55	23	n/a		87	87	68	68	64
8	36	21	n/a			65	60	18			82	82	63	63	59
9	31	16				60	45	13			77	77	58	58	54

**TYPICAL EXHAUST PIPE CONNECTIONS IN UPFLOW DIRECT OR NON-DIRECT VENT APPLICATIONS**



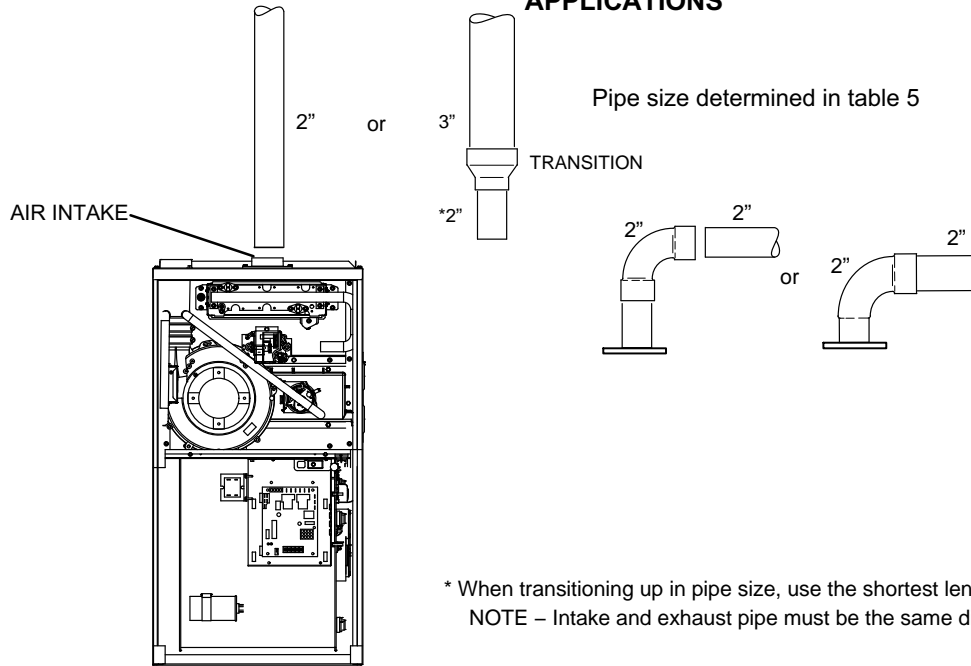
**FIGURE 24**

**TYPICAL EXHAUST PIPE CONNECTIONS IN HORIZONTAL DIRECT OR NON-DIRECT VENT APPLICATIONS (RIGHT HAND DISCHARGE SHOWN)**



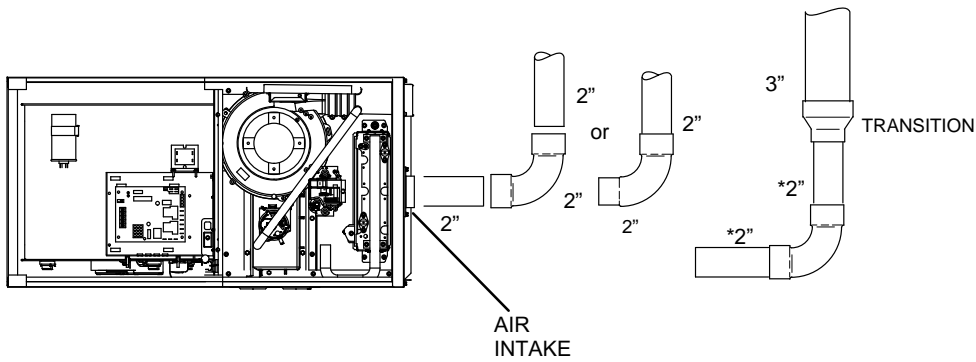
**FIGURE 25**

**TYPICAL AIR INTAKE PIPE CONNECTIONS IN UPFLOW DIRECT VENT APPLICATIONS**



**FIGURE 26**

**TYPICAL AIR INTAKE PIPE CONNECTIONS IN HORIZONTAL DIRECT VENT APPLICATIONS  
(RIGHT HAND DISCHARGE SHOWN)**



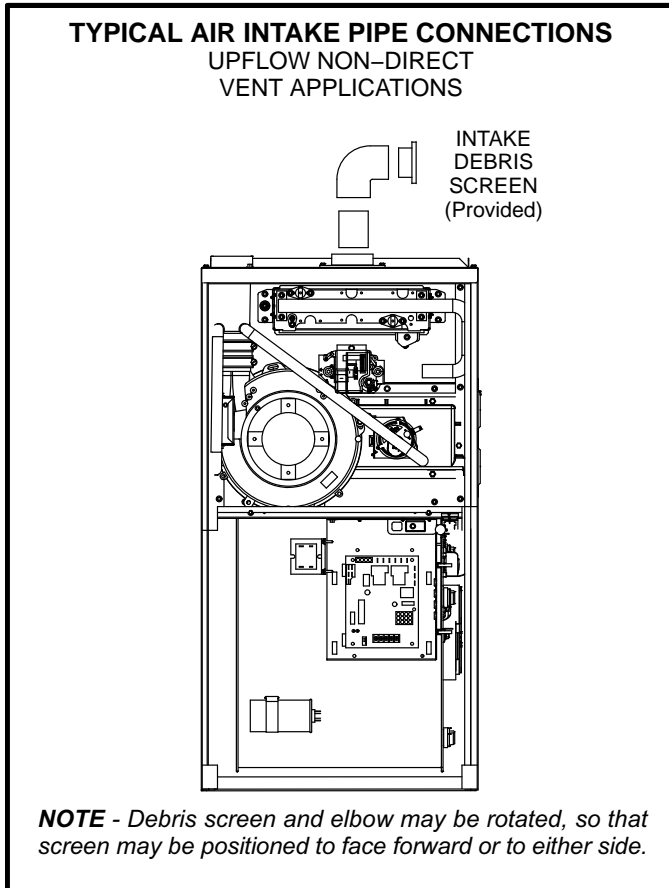
**FIGURE 27**

## Intake Piping

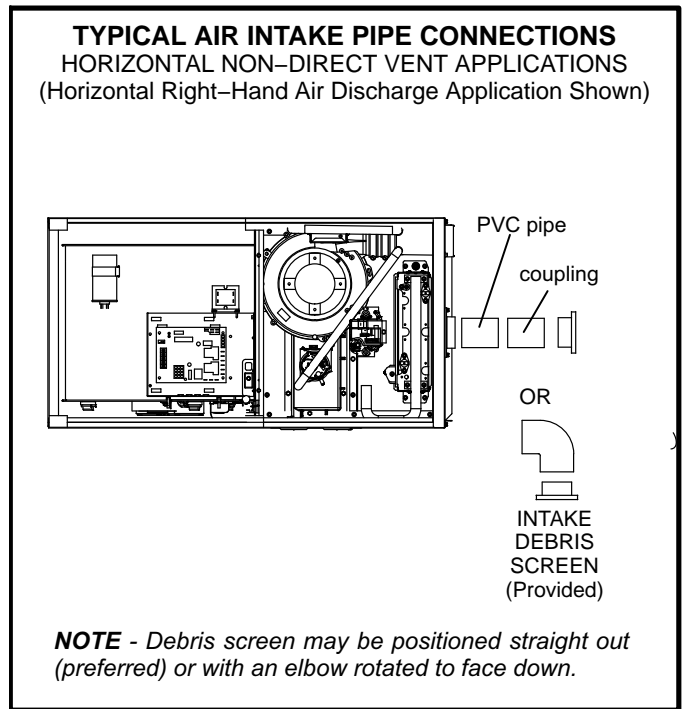
The ML193UH furnace may be installed in either **direct vent** or **non-direct vent** applications. In non-direct vent applications, when intake air will be drawn into the furnace from the surrounding space, the indoor air quality must be considered and guidelines listed in Combustion, Dilution and Ventilation Air section must be followed.

Follow the next two steps when installing the unit in **Direct Vent applications**, where combustion air is taken from outdoors and flue gases are discharged outdoors. **The provided air intake screen must not be used in direct vent applications (outdoors).**

- 1 - Use transition solvent cement or a sheet metal screw to secure the intake pipe to the inlet air connector.
- 2 - Route piping to outside of structure. Continue with installation following instructions given in general guide lines for piping terminations and intake and exhaust piping terminations for direct vent sections. Refer to table 5 for pipe sizes.



**FIGURE 28**



**FIGURE 29**

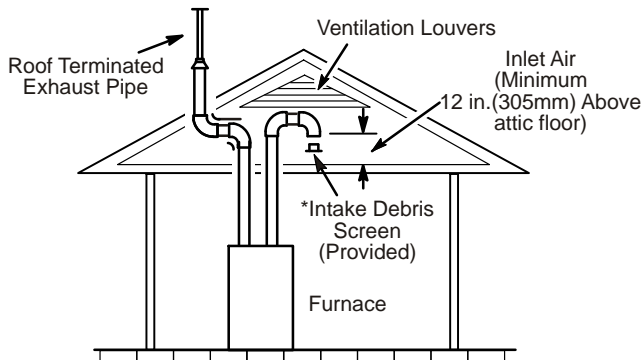
Follow the next two steps when installing the unit in **Non-Direct Vent applications** where combustion air is taken from indoors and flue gases are discharged outdoors.

- 1 - Use field-provided materials and the factory-provided air intake screen to route the intake piping as shown in figure 28 or 29. Maintain a minimum clearance of 3" (76mm) around the air intake opening. The air intake opening (with the protective screen) should always be directed forward or to either side in the upflow position, and either straight out or downward in the horizontal position.  
**The air intake piping must not terminate too close to the flooring or a platform. Ensure that the intake air inlet will not be obstructed by loose insulation or other items that may clog the debris screen.**
- 2 - If intake air is drawn from a ventilated attic (figure 30) or ventilated crawlspace (figure 31) the exhaust vent length must not exceed those listed in table 7. If 3" diameter pipe is used, reduce to 2" diameter pipe at the termination point to accommodate the debris screen. Use a sheet metal screw to secure the intake pipe to the connector, if desired.
- 3 - Use a sheet metal screw to secure the intake pipe to the connector, if desired.

## ⚠ CAUTION

If this unit is being installed in an application with combustion air coming in from a space serviced by an exhaust fan, power exhaust fan, or other device which may create a negative pressure in the space, take care when sizing the inlet air opening. The inlet air opening must be sized to accommodate the maximum volume of exhausted air as well as the maximum volume of combustion air required for all gas appliances serviced by this space.

### EQUIPMENT IN CONFINED SPACE (Inlet Air from Ventilated Attic and Outlet Air to Outside)

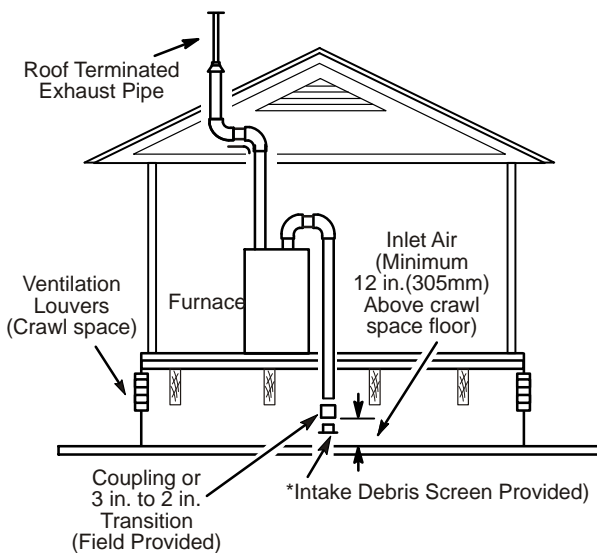


\* See table 6 for maximum vent lengths

**NOTE**-The inlet and outlet air openings shall each have a free area of at least one square inch per 4,000 Btu (645mm<sup>2</sup> per 1.17kW) per hour of the total input rating of all equipment in the enclosure.

FIGURE 30

### EQUIPMENT IN CONFINED SPACE (Inlet Air from Ventilated Crawlspace and Outlet Air to Outside)



\* See table 6 for maximum vent lengths

**NOTE**-The inlet and outlet air openings shall each have a free area of at least one square inch per 4,000 Btu (645mm<sup>2</sup> per 1.17kW) per hour of the total input rating of all equipment in the enclosure.

FIGURE 31

## General Guidelines for Vent Terminations

In Non-Direct Vent applications, combustion air is taken from indoors and the flue gases are discharged to the outdoors. The ML193UH is then classified as a non-direct vent, Category IV gas furnace.

In Direct Vent applications, combustion air is taken from outdoors and the flue gases are discharged to the outdoors. The ML193UH is then classified as a direct vent, Category IV gas furnace.

In both Non-Direct Vent and Direct Vent applications, the vent termination is limited by local building codes. In the absence of local codes, refer to the current National Fuel Gas Code ANSI Z223-1/NFPA 54 in U.S.A., and current CSA-B149 Natural Gas and Propane Installation Codes in Canada for details.

Position termination according to location given in figure 33 or 34. In addition, position termination so it is free from any obstructions and 12" above the average snow accumulation.

At vent termination, care must be taken to maintain protective coatings over building materials (prolonged exposure to exhaust condensate can destroy protective coatings). It is recommended that the exhaust outlet not be located within 6 feet (1.8m) of an outdoor AC unit because the condensate can damage the painted coating.

**NOTE** - See table 7 for maximum allowed exhaust pipe length without insulation in unconditioned space during winter design temperatures below 32°F (0°C). If required exhaust pipe should be insulated with 1/2" (13mm) Armaflex or equivalent. In extreme cold climate areas, 3/4" (19mm) Armaflex or equivalent may be necessary. Insulation must be protected from deterioration. Armaflex with UV protection is permissible. Basements or other enclosed areas that are not exposed to the outdoor ambient temperature and are above 32 degrees F (0°C) are to be considered conditioned spaces.

## ⚠ IMPORTANT

Do not use screens or perforated metal in exhaust terminations. Doing so will cause freeze-ups and may block the terminations.

## ⚠ IMPORTANT

**For Canadian Installations Only:**  
In accordance to CSA International B149 installation codes, the minimum allowed distance between the combustion air intake inlet and the exhaust outlet of other appliances shall not be less than 12 inches (305mm).

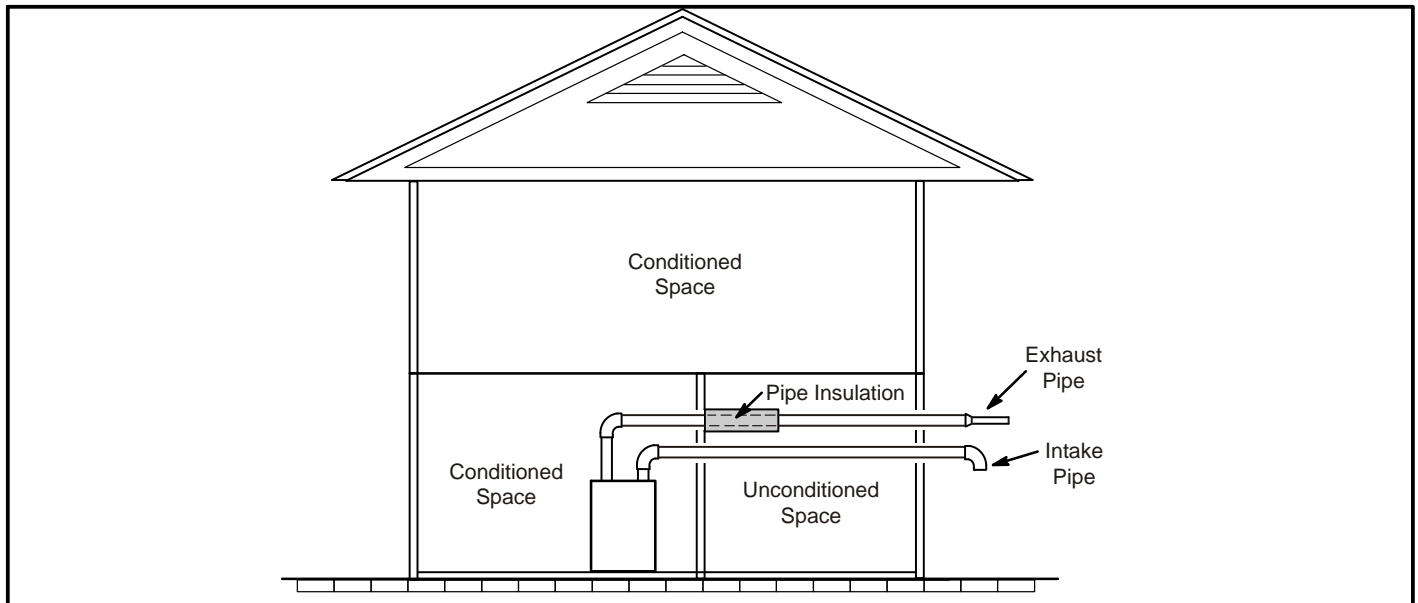
**TABLE 7**  
**Maximum Allowable Exhaust Vent Pipe Length (in ft.) Without Insulation In Unconditioned Space For**  
**Winter Design Temperatures Single - Stage High Efficiency Furnace**

Winter Design Temperatures <sup>1</sup> °F (°C)	Vent Pipe Diameter	Unit Input Size				
		045	070	090	110	135
32 to 21 (0 to -6)		PVC	PVC	PVC	PVC	PVC
	2 in.	26	44	44	24	N/A
	2-1/2 in.	18	32	50	58	N/A
	3 in.	14	26	38	55	60
20 to 1 (-7 to -17)	2 in.	16	28	40	24	N/A
	2-1/2 in.	12	20	30	44	N/A
	3 in.	9	16	26	32	40
0 to -20 (-18 to -29)	2 in.	10	20	30	24	N/A
	2-1/2 in.	8	14	20	32	N/A
	3 in.	4	10	16	26	30

<sup>1</sup>Refer to 99% Minimum Design Temperature table provided in the current edition of the ASHRAE Fundamentals Handbook.

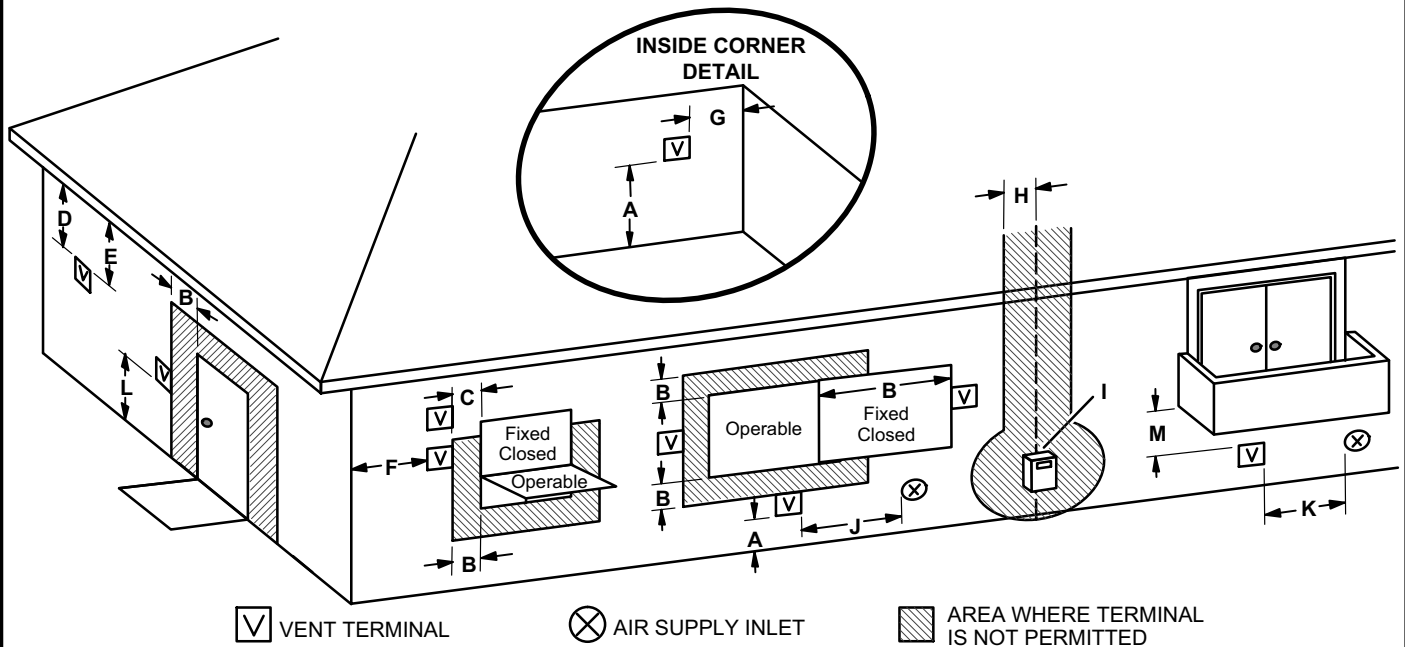
NOTE - Maximum uninsulated vent lengths listed may include the termination (vent pipe exterior to the structure) and cannot exceed 5 linear feet or the maximum allowable intake or exhaust vent length listed in table 5 or 6 which ever is less.

NOTE - If insulation is required in an unconditioned space, it must be located on the pipe closest to the furnace. See figure32.



**FIGURE 32**

## VENT TERMINATION CLEARANCES FOR NON-DIRECT VENT INSTALLATIONS IN THE USA AND CANADA



	US Installations <sup>1</sup>	Canadian Installations <sup>2</sup>	
A =	Clearance above grade, veranda, porch, deck or balcony	12 inches (305mm) or 12 in. (305mm) above average snow accumulation.	12 inches (305mm) or 12 in. (305mm) above average snow accumulation.
B =	Clearance to window or door that may be opened	4 feet (1.2 m) below or to side of opening; 1 foot (30cm) above opening	6 inches (152mm) for appliances <10,000 Btuh (3kw), 12 inches (305mm) for appliances > 10,000 Btuh (3kw) and <100,000 Btuh (30kw), 36 inches (.9m) for appliances > 100,000 Btuh (30kw)
C =	Clearance to permanently closed window	* 12"	* 12"
D =	Vertical clearance to ventilated soffit located above the terminal within a horizontal distance of 2 feet (610 mm) from the center line of the terminal	* Equal to or greater than soffit depth.	* Equal to or greater than soffit depth.
E =	Clearance to unventilated soffit	* Equal to or greater than soffit depth.	* Equal to or greater than soffit depth.
F =	Clearance to outside corner	* No minimum to outside corner	* No minimum to outside corner
G =	Clearance to inside corner	*	*
H =	Clearance to each side of center line extended above meter / regulator assembly	* 3 feet (.9m) within a height 15 feet (4.5m) above the meter / regulator assembly	3 feet (.9m) within a height 15 feet (4.5m) above the meter / regulator assembly
I =	Clearance to service regulator vent outlet	* 3 feet (.9m)	3 feet (.9m)
J =	Clearance to non-mechanical air supply inlet to building or the combustion air inlet to any other appliance	4 feet (1.2 m) below or to side of opening; 1 foot (30 cm) above opening	6 inches (152mm) for appliances <10,000 Btuh (3kw), 12 inches (305mm) for appliances > 10,000 Btuh (3kw) and <100,000 Btuh (30kw), 36 inches (.9m) for appliances > 100,000 Btuh (30kw)
K =	Clearance to mechanical air supply inlet	3 feet (.9m) above if within 10 feet (3m) horizontally	6 feet (1.8m)
L =	Clearance above paved sidewalk or paved driveway located on public property	7 feet (2.1m)†	7 feet (2.1m)†
M =	Clearance under veranda, porch, deck or balcony	*12 inches (305mm)‡	12 inches (305mm)‡

<sup>1</sup> In accordance with the current ANSI Z223.1/NFPA 54 Natural Fuel Gas Code

<sup>2</sup> In accordance with the current CSA B149.1, Natural Gas and Propane Installation Code  
 † A vent shall not terminate directly above a sidewalk or paved driveway that is located between two single family dwellings and serves both dwellings.

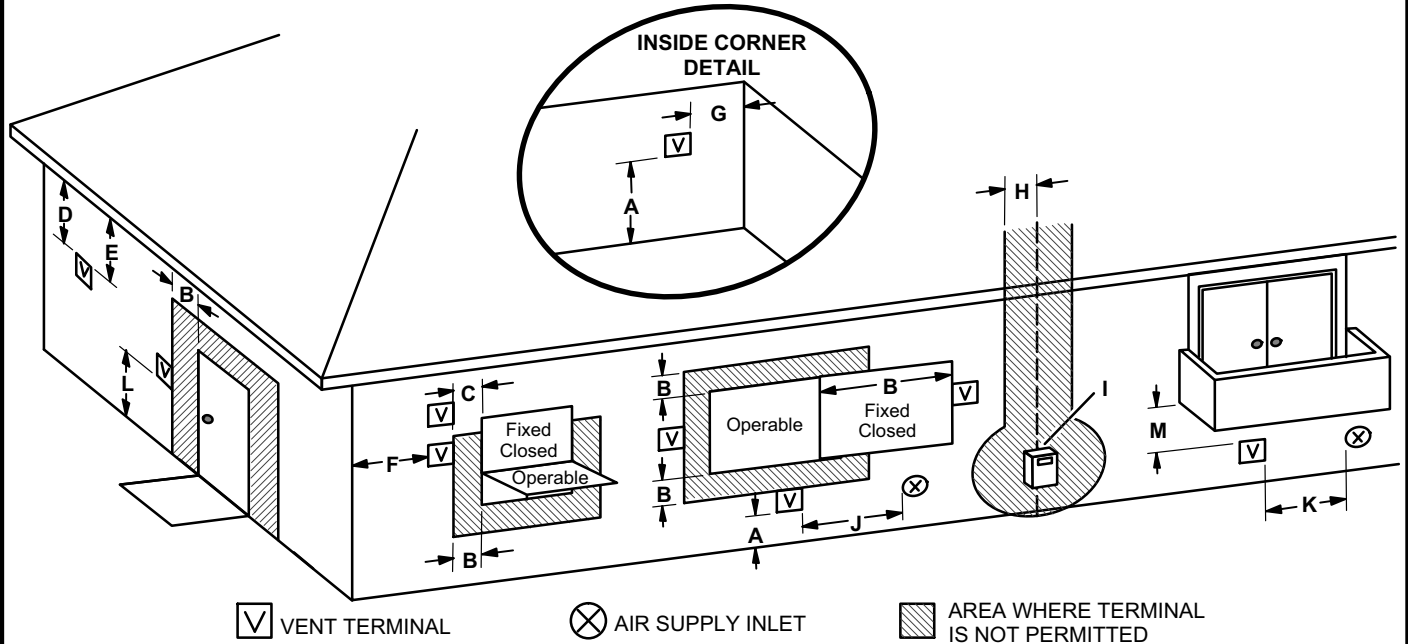
‡ Permitted only if veranda, porch, deck or balcony is fully open on a minimum of two sides beneath the floor. Lennox recommends avoiding this location if possible.

\*For clearances not specified in ANSI Z223.1/NFPA 54 or CSA B149.1, clearance will be in accordance with local installation codes and the requirements of the gas supplier and these installation instructions."

**FIGURE 33**



## VENT TERMINATION CLEARANCES FOR DIRECT VENT INSTALLATIONS IN THE USA AND CANADA



	US Installations <sup>1</sup>	Canadian Installations <sup>2</sup>	
A =	Clearance above grade, veranda, porch, deck or balcony	12 inches (305mm) or 12 in. (305mm) above average snow accumulation.	12 inches (305mm) or 12 in. (305mm) above average snow accumulation.
B =	Clearance to window or door that may be opened	6 inches (152mm) for appliances <10,000 Btuh (3kw), 9 inches (228mm) for appliances > 10,000 Btuh (3kw) and <50,000 Btuh (15 kw), 12 inches (305mm) for appliances > 50,000 Btuh (15kw)	6 inches (152mm) for appliances <10,000 Btuh (3kw), 12 inches (305mm) for appliances > 10,000 Btuh (3kw) and <100,000 Btuh (30kw), 36 inches (.9m) for appliances > 100,000 Btuh (30kw)
C =	Clearance to permanently closed window	* 12"	* 12"
D =	Vertical clearance to ventilated soffit located above the terminal within a horizontal distance of 2 feet (610mm) from the center line of the terminal	* Equal to or greater than soffit depth	* Equal to or greater than soffit depth
E =	Clearance to unventilated soffit	* Equal to or greater than soffit depth	* Equal to or greater than soffit depth
F =	Clearance to outside corner	* No minimum to outside corner	* No minimum to outside corner
G =	Clearance to inside corner	*	*
H =	Clearance to each side of center line extended above meter / regulator assembly	3 feet (.9m) within a height 15 feet (4.5m) above the meter / regulator assembly	3 feet (.9m) within a height 15 feet (4.5m) above the meter / regulator assembly
I =	Clearance to service regulator vent outlet	* 3 feet (.9m)	3 feet (.9m)
J =	Clearance to non-mechanical air supply inlet to building or the combustion air inlet to any other appliance	6 inches (152mm) for appliances <10,000 Btuh (3kw), 9 inches (228mm) for appliances > 10,000 Btuh (3kw) and <50,000 Btuh (15 kw), 12 inches (305mm) for appliances > 50,000 Btuh (15kw)	6 inches (152mm) for appliances <10,000 Btuh (3kw), 12 inches (305mm) for appliances > 10,000 Btuh (3kw) and <100,000 Btuh (30kw), 36 inches (.9m) for appliances > 100,000 Btuh (30kw)
K =	Clearance to mechanical air supply inlet	3 feet (.9m) above if within 10 feet (3m) horizontally	6 feet (1.8m)
L =	Clearance above paved sidewalk or paved driveway located on public property	* 7 feet (2.1m)	7 feet (2.1m)†
M =	Clearance under veranda, porch, deck or balcony	*12 inches (305mm)‡	12 inches (305mm)‡

<sup>1</sup> In accordance with the current ANSI Z223.1/NFPA 54 Natural Fuel Gas Code

<sup>2</sup> In accordance with the current CSA B149.1, Natural Gas and Propane Installation Code

† A vent shall not terminate directly above a sidewalk or paved driveway that is located between two single family dwellings and serves both dwellings.

‡ Permitted only if veranda, porch, deck or balcony is fully open on a minimum of two sides beneath the floor. Lennox recommends avoiding this location if possible.

\*For clearances not specified in ANSI Z223.1/NFPA 54 or CSA B149.1, clearance will be in accordance with local installation codes and the requirements of the gas supplier and these installation instructions."

**FIGURE 34**

## Details of Intake and Exhaust Piping Terminations for Direct Vent Installations

**NOTE** - In Direct Vent installations, combustion air is taken from outdoors and flue gases are discharged to outdoors.

**NOTE** - Flue gas may be slightly acidic and may adversely affect some building materials. If any vent termination is used and the flue gasses may impinge on the building material, a corrosion-resistant shield (minimum 24 inches square) should be used to protect the wall surface. If the optional tee is used, the protective shield is recommended. The shield should be constructed using wood, plastic, sheet metal or other suitable material. All seams, joints, cracks, etc. in the affected area should be sealed using an appropriate sealant. See figure 42.

Intake and exhaust pipes may be routed either horizontally through an outside wall or vertically through the roof. In attic or closet installations, vertical termination through the roof is preferred. Figures 35 through 43 show typical terminations.

- 1 - Intake and exhaust terminations are not required to be in the same pressure zone. You may exit the intake on one side of the structure and the exhaust on another side (figure 36). You may exit the exhaust out the roof and the intake out the side of the structure (figure 37).

**NOTE** - When venting in different pressure zones, maximum separation of intake and exhaust pipe DO NOT apply.

- 2 - Intake and exhaust pipes should be placed as close together as possible at termination end (refer to illustrations). Maximum separation is 3" (76mm) on roof terminations and 6" (152mm) on side wall terminations.

**NOTE** - When venting in different pressure zones, the maximum separation requirement of intake and exhaust pipe DOES NOT apply.

- 3 - On roof terminations, the intake piping should terminate straight down using two 90° elbows (See figure 35).
- 4 - Exhaust piping must terminate straight out or up as shown. A reducer may be required on the exhaust piping at the point where it exits the structure to improve the velocity of exhaust away from the intake piping. See table 8.

- 5 - On field supplied terminations for side wall exit, exhaust piping may extend a maximum of 12 inches (305mm) for 2" PVC and 20 inches (508mm) for 3" (76mm) PVC beyond the outside wall. Intake piping should be as short as possible.

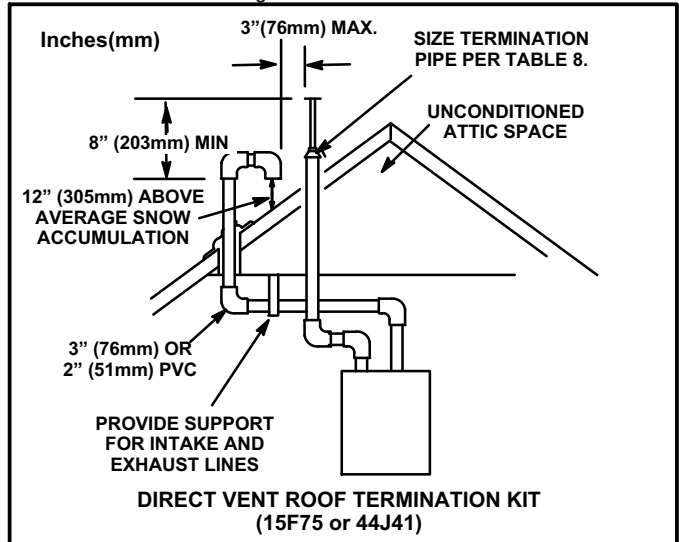
- 6 - On field supplied terminations, a minimum distance between the end of the exhaust pipe and the end of the intake pipe without a termination elbow is 8" and a minimum distance of 6" with a termination elbow.

**NOTE** - Care must be taken to avoid recirculation of exhaust back into intake pipe.

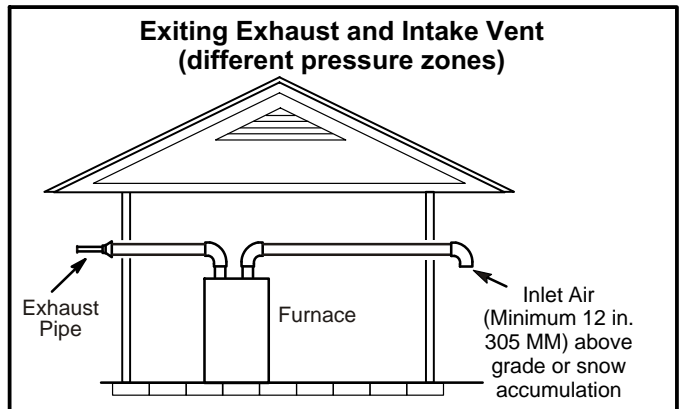
**TABLE 8  
EXHAUST PIPE TERMINATION SIZE REDUCTION**

ML193UH MODEL	Termination Pipe Size
*045 and 070	1-1/2" (38mm)
*090	2" (51mm)
110	2" (51mm)
135	2" (51mm)

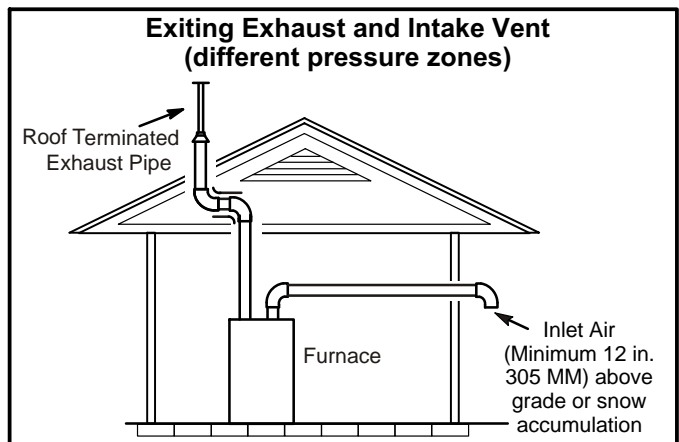
\*ML193UH-045, -070 and -090 units with the flush mount termination must use the 1-1/2" accelerator supplied with the kit unless a tee is used for termination as shown figure 42.



**FIGURE 35**

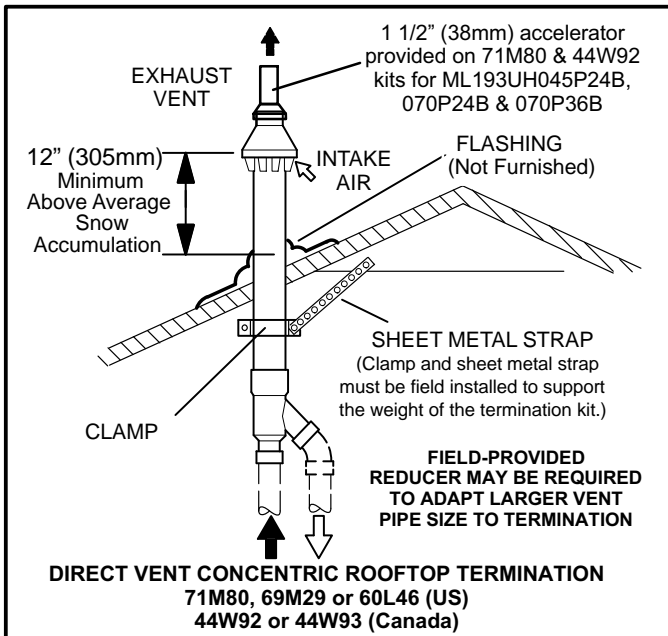


**FIGURE 36**

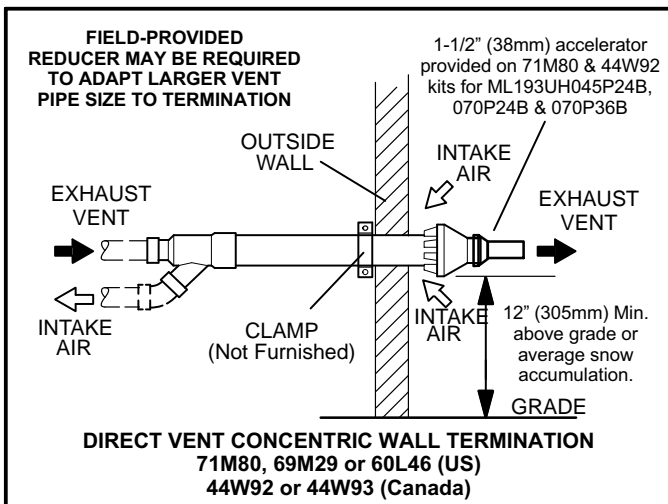


**FIGURE 37**

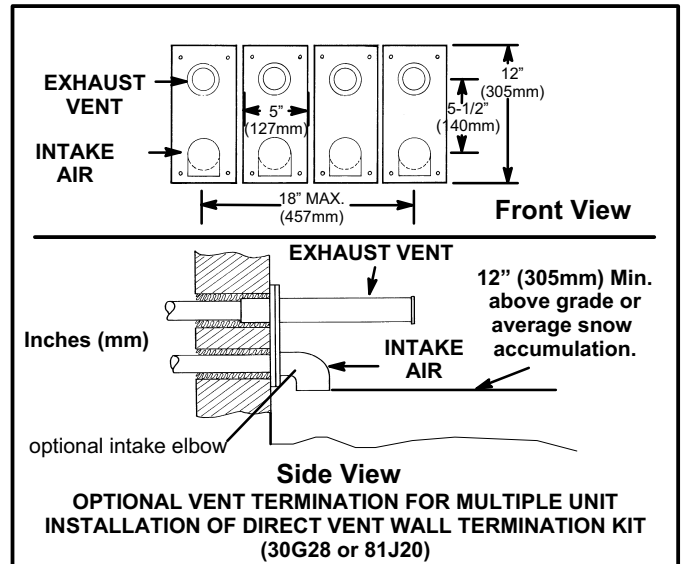
- 7 - If intake and exhaust piping must be run up a side wall to position above snow accumulation or other obstructions, piping must be supported. At least one bracket must be used within 6" from the top of the elbow and then every 24" (610mm) as shown in figure 42, to prevent any movement in any direction. When exhaust and intake piping must be run up an outside wall, the exhaust piping must be terminated with pipe sized per table 8. The intake piping may be equipped with a 90° elbow turndown. Using turndown will add 5 feet (1.5m) to the equivalent length of the pipe.
- 8 - A multiple furnace installation may use a group of up to four terminations assembled together horizontally, as shown in figure 40.



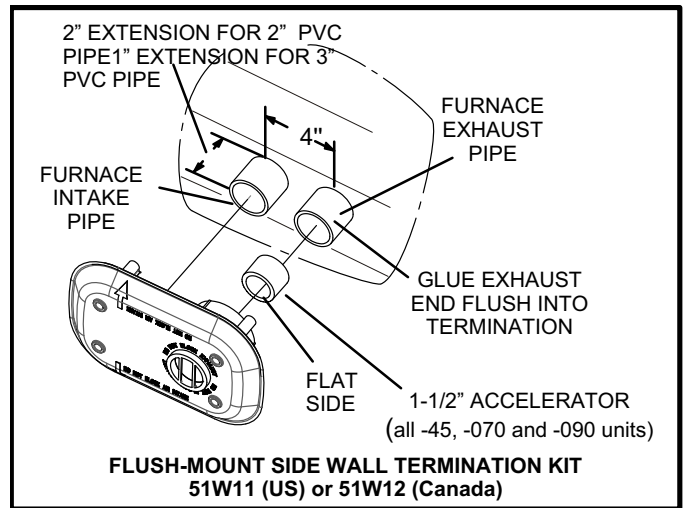
**FIGURE 38**



**FIGURE 39**



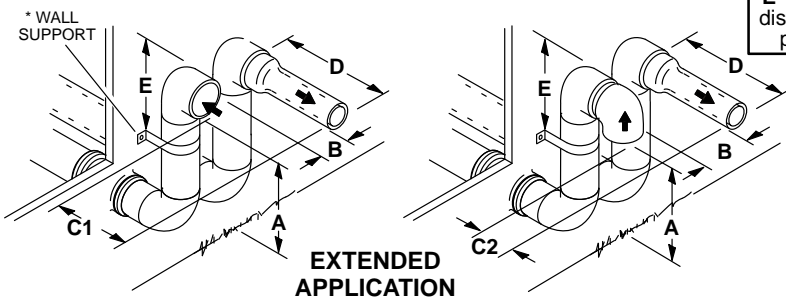
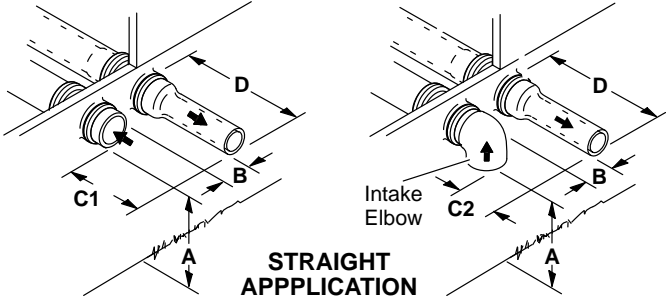
**FIGURE 40**



**FIGURE 41**

## FIELD FABRICATED WALL TERMINATION

NOTE – FIELD-PROVIDED REDUCER MAY BE REQUIRED TO ADAPT LARGER VENT PIPE SIZE TO TERMINATION



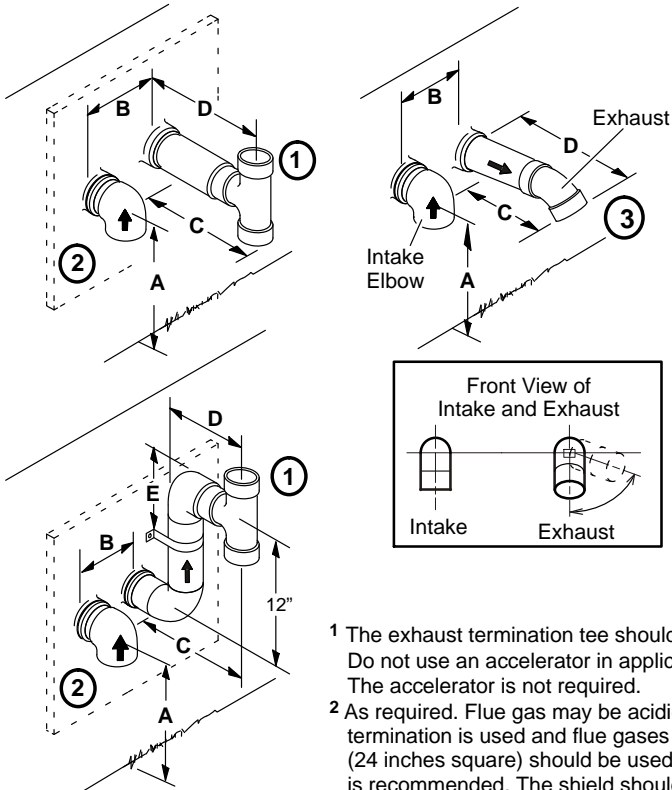
	2" (51mm) Vent Pipe	3" (76mm) Vent Pipe
<b>A</b> – Minimum clearance above grade or average snow accumulation	12" (305 mm)	12" (305 mm)
<b>B</b> – Maximum horizontal separation between intake and exhaust	6" (152 mm)	6" (152 mm)
<b>C1</b> –Minimum from end of exhaust to inlet of intake	8" (203 mm)	8" (203 mm)
<b>C2</b> –Minimum from end of exhaust to inlet of intake	6" (152 mm)	6" (152 mm)
<b>D</b> – Maximum exhaust pipe length	12" (305 mm)	20" (508 mm)
<b>E</b> – Maximum wall support distance from top of each pipe (intake/exhaust)	6" (152 mm)	6" (152 mm)

See venting table 5 for maximum venting lengths with this arrangement.

\* Use wall support every 24" (610 mm). Use two wall supports if extension is greater than 24" (610 mm) but less than 48" (1219 mm).

NOTE – One wall support must be within 6" (152 mm) from top of each pipe (intake and exhaust) to prevent movement in any direction.

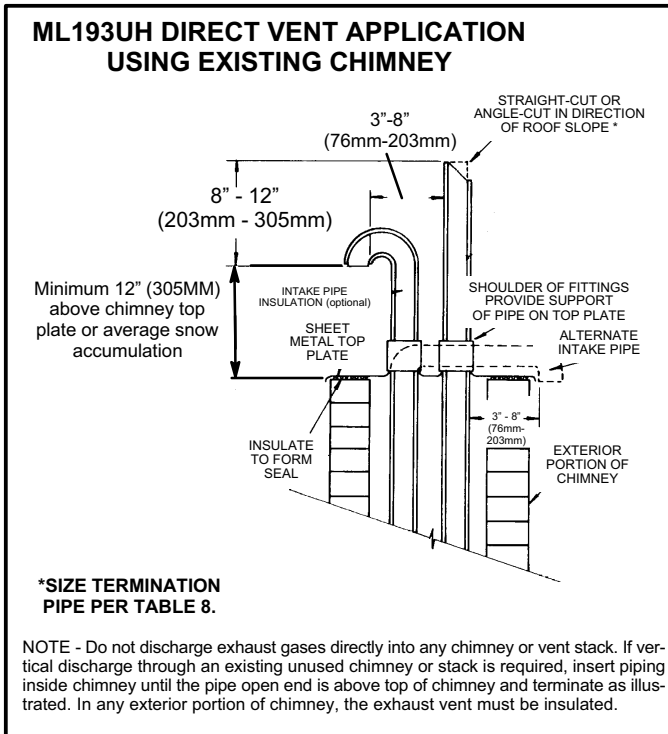
## ALTERNATE TERMINATIONS (TEE & FORTY-FIVE DEGREE ELBOWS ONLY)



	2" (51MM) Vent Pipe	3" (76MM) Vent Pipe
<b>A</b> – Clearance above grade or average snow accumulation	12" (305 mm) Min.	12" (305 mm) Min.
<b>B</b> – Horizontal separation between intake and exhaust	6" (152 mm) Min. 24" (610 mm) Max.	6" (152 mm) Min. 24" (610 mm) Max.
<b>C</b> – Minimum from end of exhaust to inlet of intake	9" (227 mm) Min.	9" (227 mm) Min.
<b>D</b> – Exhaust pipe length	12" (305 mm) Min. 16" (405 mm) Max.	12" (305 mm) Min. 20" (508 mm) Max.
<b>E</b> – Wall support distance from top of each pipe (intake/exhaust)	6" (152 mm) Max.	6" (152 mm) Max.

- 1 The exhaust termination tee should be connected to the 2" or 3" PVC flue pipe as shown in the illustration. Do not use an accelerator in applications that include an exhaust termination tee. The accelerator is not required.
- 2 As required. Flue gas may be acidic and may adversely affect some building materials. If a side wall vent termination is used and flue gases will impinge on the building materials, a corrosion-resistant shield (24 inches square) should be used to protect the wall surface. If optional tee is used, the protective shield is recommended. The shield should be constructed using wood, sheet metal or other suitable material. All seams, joints, cracks, etc. in affected area, should be sealed using an appropriate sealant.
- 3 Exhaust pipe 45° elbow can be rotated to the side away from the combustion air inlet to direct exhaust away from adjacent property. The exhaust must never be directed toward the combustion air inlet.

**FIGURE 42**

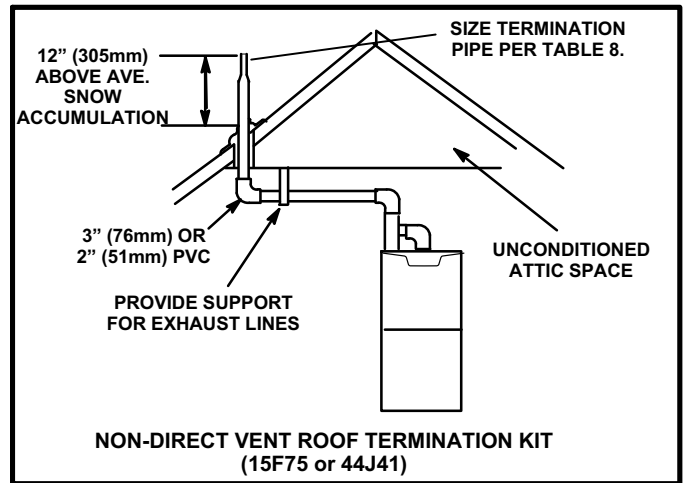


**FIGURE 43**

**Details of Exhaust Piping Terminations for Non-Direct Vent Applications**

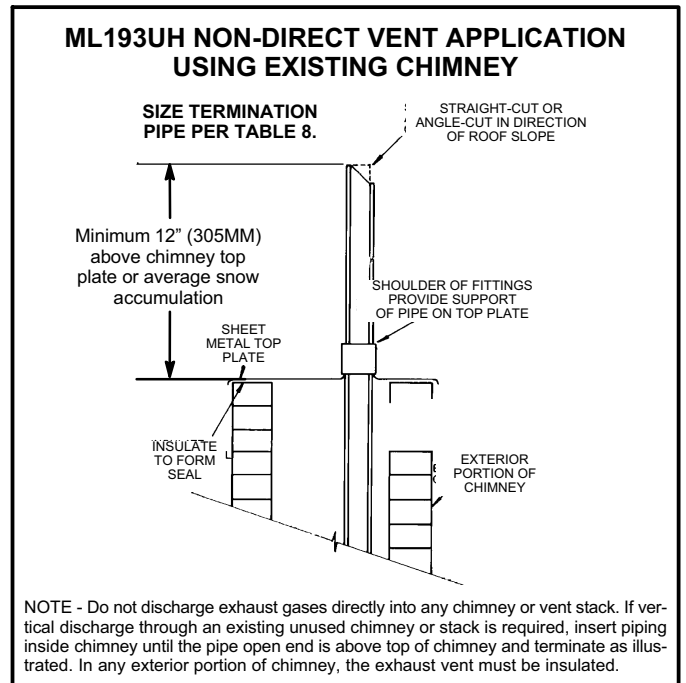
Exhaust pipes may be routed either horizontally through an outside wall or vertically through the roof. In attic or closet installations, vertical termination through the roof is preferred. Figures 44 through 45 show typical terminations.

- 1 - Exhaust piping must terminate straight out or up as shown. The termination pipe must be sized as listed in table 8. The specified pipe size ensures proper velocity required to move the exhaust gases away from the building.
- 2 - On field supplied terminations for side wall exit, exhaust piping may extend a maximum of 12 inches (305mm) for 2" PVC and 20 inches (508mm) for 3" (76mm) PVC beyond the outside wall.



**FIGURE 44**

- 3 - If exhaust piping must be run up a side wall to position above snow accumulation or other obstructions, piping must be supported every 24 inches (610mm). When exhaust piping must be run up an outside wall, any reduction in exhaust pipe size must be done after the final elbow.
- 4 - Distance between exhaust pipe terminations on multiple furnaces must meet local codes.



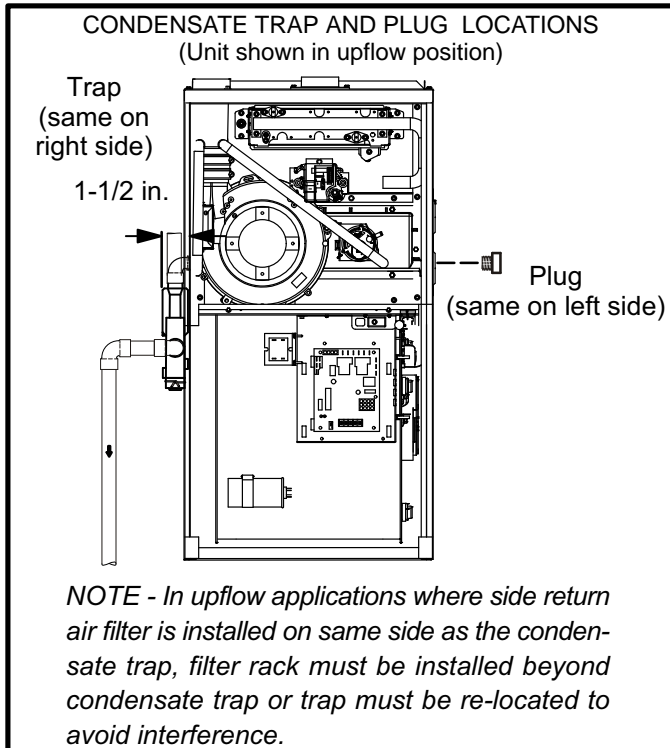
**FIGURE 45**

**Condensate Piping**

This unit is designed for either right- or left-side exit of condensate piping in upflow applications. In horizontal applications, the condensate trap must extend below the unit. An 8" service clearance is required for the condensate trap. Refer to figures 46 and 48 for condensate trap locations. Figure 54 shows trap assembly using 1/2" PVC or 3/4" PVC.

**NOTE** - If necessary the condensate trap may be installed up to 5' away from the furnace. Use PVC pipe to connect trap to furnace condensate outlet. Piping from furnace must slope down a minimum of 1/4" per ft. toward trap.

- 1 - Determine which side condensate piping will exit the unit, location of trap, field-provided fittings and length of PVC pipe required to reach available drain.
- 2 - Use a large flat head screw driver or a 1/2" drive socket extension and remove plug (figure 46) from the cold end header box at the appropriate location on the side of the unit. Install provided 3/4 NPT street elbow fitting into cold end header box. Use Teflon tape or appropriate pipe dope.
- 3 - Install the cap over the clean out opening at the base of the trap. Secure with clamp. See figure 54.
- 4 - Install drain trap using appropriate PVC fittings, glue all joints. Glue the provided drain trap as shown in figure 54. Route the condensate line to an open drain. Condensate line must maintain a 1/4" downward slope from the furnace to the drain.



**FIGURE 46**

- 5 - Figures 49 and 51 show the furnace and evaporator coil using a separate drain. If necessary the condensate line from the furnace and evaporator coil can drain together. See figures 50, 52 and 53.  
*Upflow furnace (figure 52)* - In upflow furnace applica-

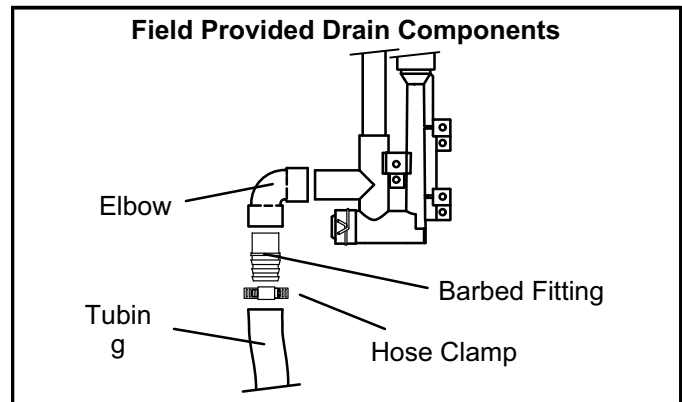
tions the field provided vent must be a minimum 1" to a maximum 2" length above the condensate drain outlet connection. Any length above 2" may result in a flooded heat exchanger if the combined primary drain line were to become restricted.

*Horizontal furnace (figure 53)* - In horizontal furnace applications the field provided vent must be a minimum 4" to a maximum 5" length above the condensate drain outlet connection. Any length above 5" may result in a flooded heat exchanger if the combined primary drain line were to become restricted.

**NOTE** - In horizontal applications it is recommended to install a secondary drain pan underneath the unit and trap assembly.

**NOTE** - Appropriately sized tubing and barbed fitting may be used for condensate drain. Attach to the drain on the trap using a hose clamp. See figure 47.

- 6 - If unit will be started immediately upon completion of installation, prime trap per procedure outlined in Unit Start-Up section.



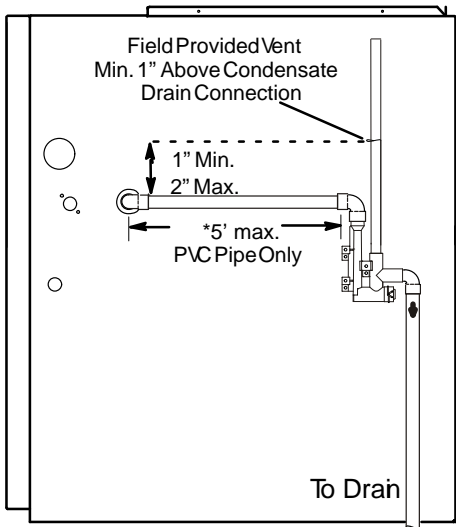
**FIGURE 47**

**⚠ CAUTION**

**Do not use copper tubing or existing copper condensate lines for drain line.**

Condensate line must slope downward away from the trap to drain. If drain level is above condensate trap, condensate pump must be used. Condensate drain line should be routed within the conditioned space to avoid freezing of condensate and blockage of drain line. If this is not possible, a heat cable kit may be used on the condensate trap and line. Heating cable kit is available from Lennox in various lengths; 6 ft. (1.8m) - kit no. 26K68; 24 ft. (7.3m) - kit no. 26K69; and 50 ft. (15.2m) - kit no. 26K70.

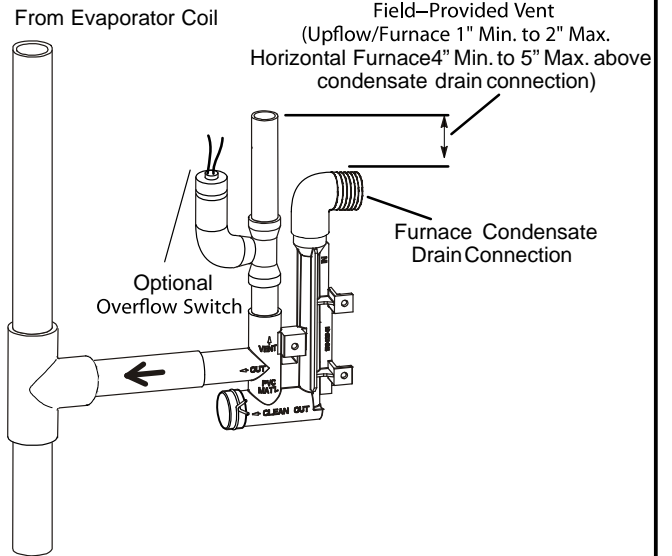
**CONDENSATE TRAP LOCATIONS**  
(Units in upflow position with remote trap)



\*Piping from furnace must slope down a minimum of 1/4" per ft. toward trap.

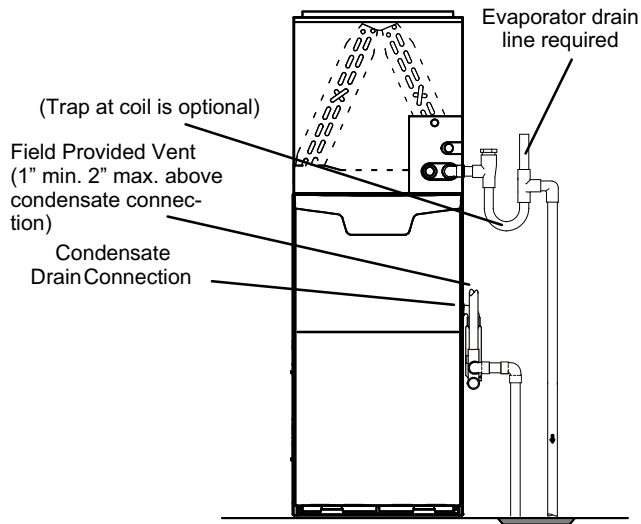
**FIGURE 48**

**Condensate Trap With Optional Overflow Switch**

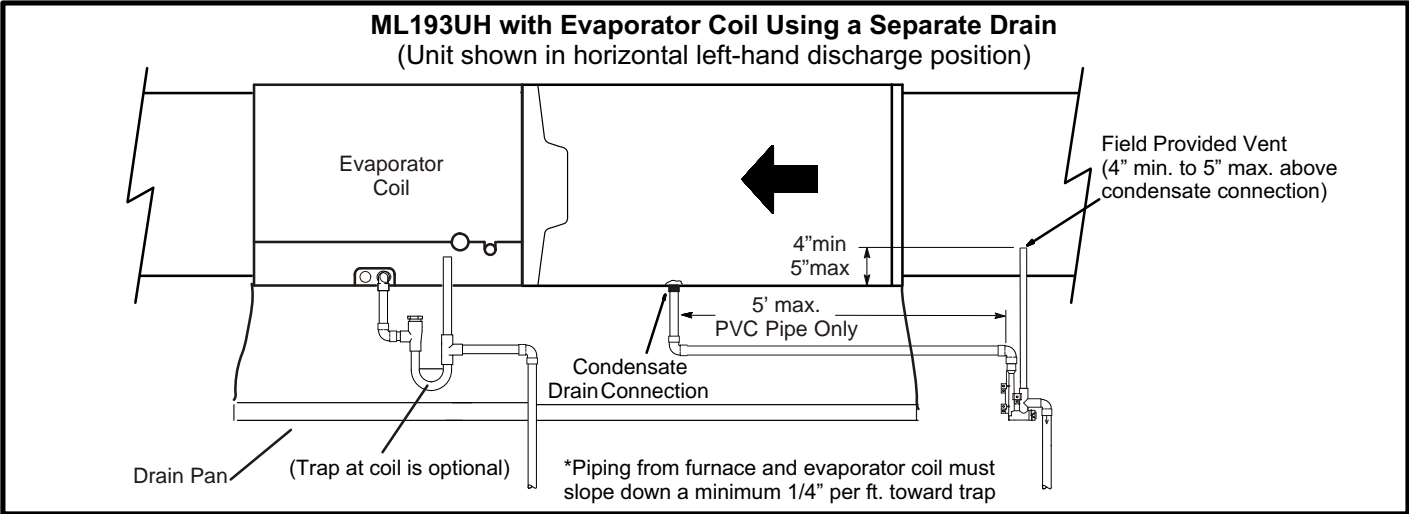


**FIGURE 50**

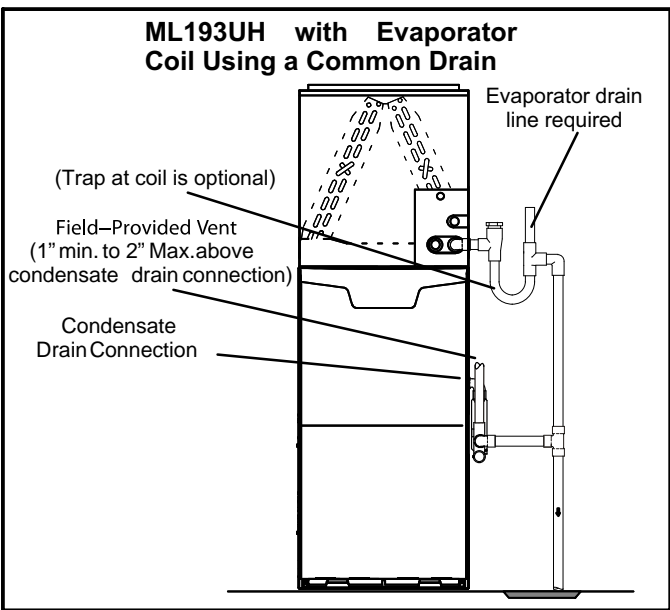
**ML193UH With Evaporator Coil Using A Separate Drain**



**FIGURE 49**



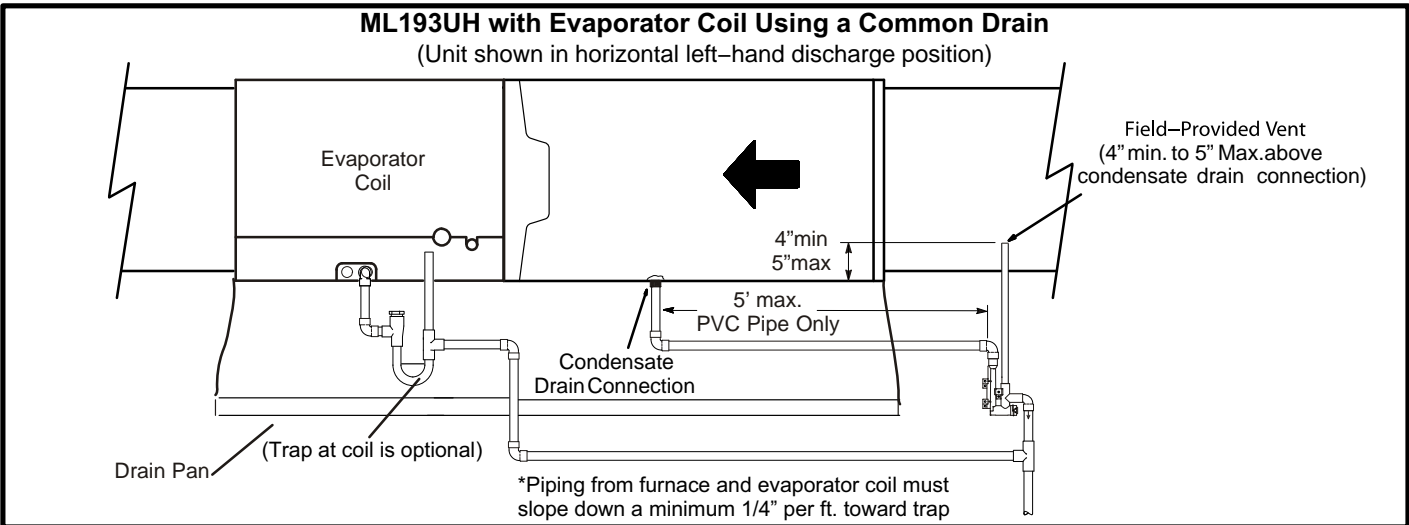
**FIGURE 51**



**FIGURE 52**

**! IMPORTANT**

**When combining the furnace and evaporator coil drains together, the A/C condensate drain outlet must be vented to relieve pressure in order for the furnace pressure switch to operate properly.**

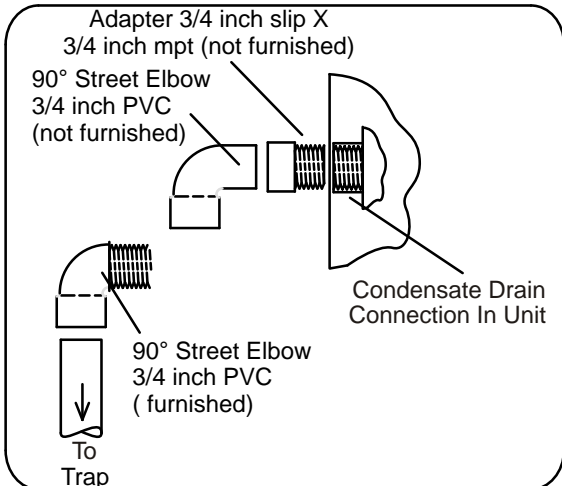


**FIGURE 53**

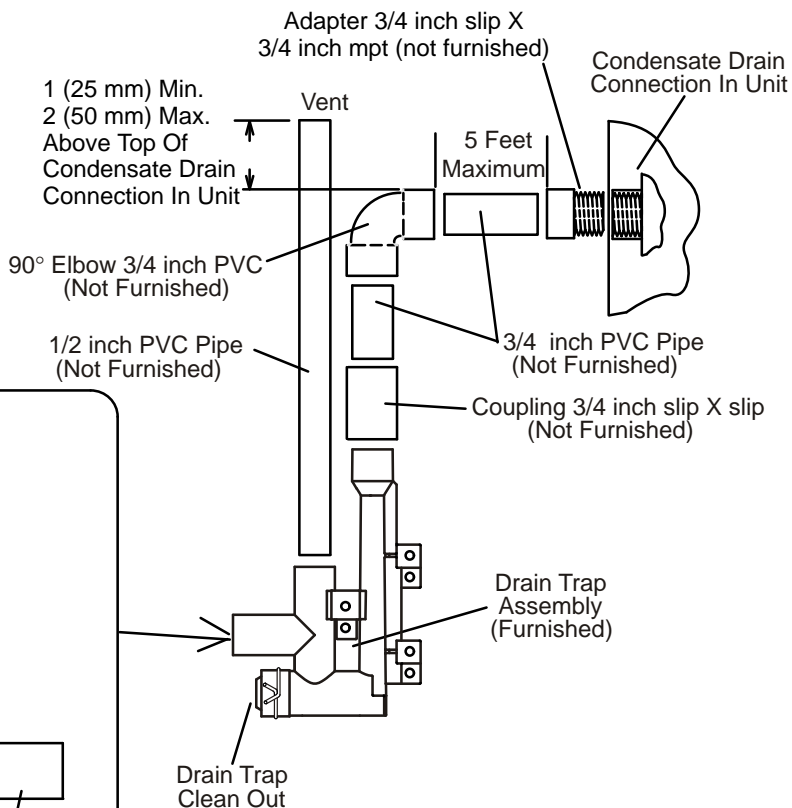
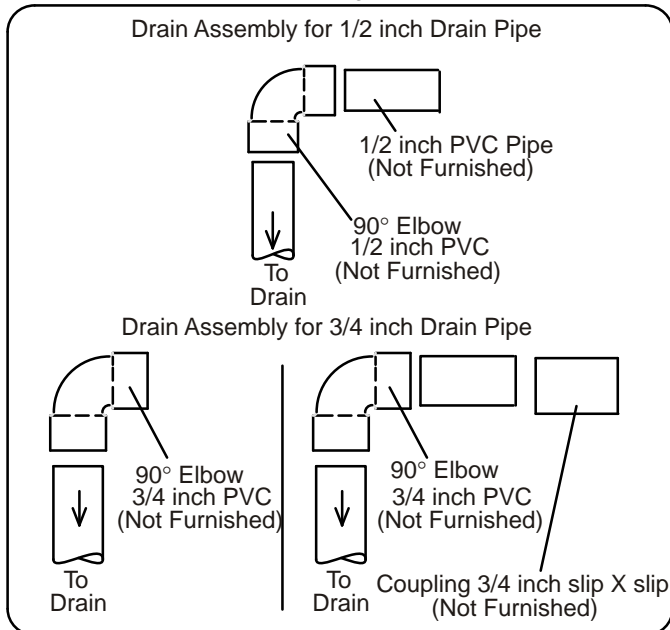


### TRAP / DRAIN ASSEMBLY USING 1/2" PVC OR 3/4" PVC

#### Optional Condensate Drain Connection

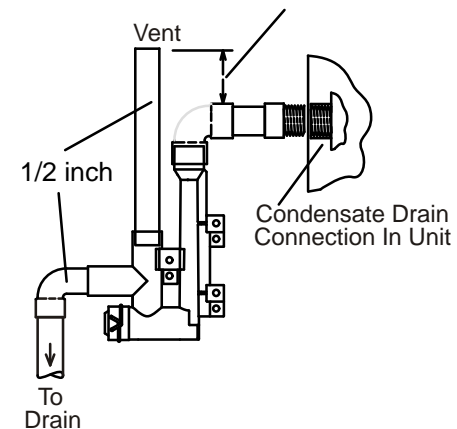


#### Optional Drain Piping From Trap



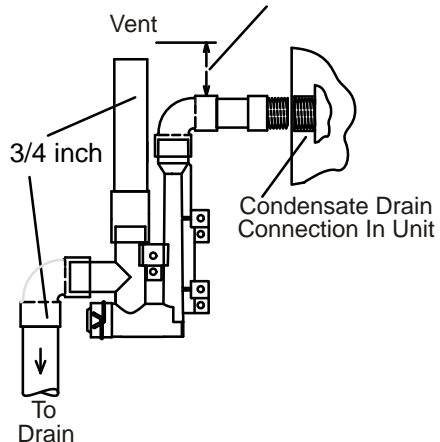
#### Drain Trap Assembly with 1/2 inch Piping

1 (25 mm) Min. 2 (50 mm) Max. Above Top Of Condensate Drain Connection In Unit



#### Drain Trap Assembly with 3/4 inch Piping

1 (25 mm) Min. 2 (50 mm) Max. Above Top Of Condensate Drain Connection In Unit



#### Drain Trap Assembly (Furnished)

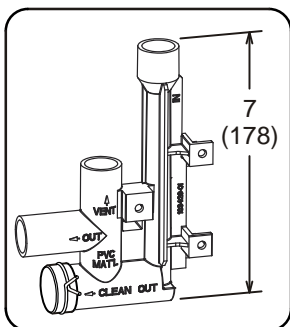


FIGURE 54

## Gas Piping

### ⚠ CAUTION

If a flexible gas connector is required or allowed by the authority that has jurisdiction, black iron pipe shall be installed at the gas valve and extend outside the furnace cabinet. The flexible connector can then be added between the black iron pipe and the gas supply line.

### ⚠ WARNING

Do not exceed 600 in-lbs (50 ft-lbs) torque when attaching the gas piping to the gas valve.

- 1 - Gas piping may be routed into the unit through either the left- or right-hand side. Supply piping enters into the gas valve from the side of the valve as shown in figure 57. Move Bellows grommet to side which gas line enters. Ensure opposite gas line hole is plugged with supplied plug.

### ⚠ IMPORTANT

When converting the ML193 unit from natural gas to LP/propane install the field provided low pressure switch. See figure 55.

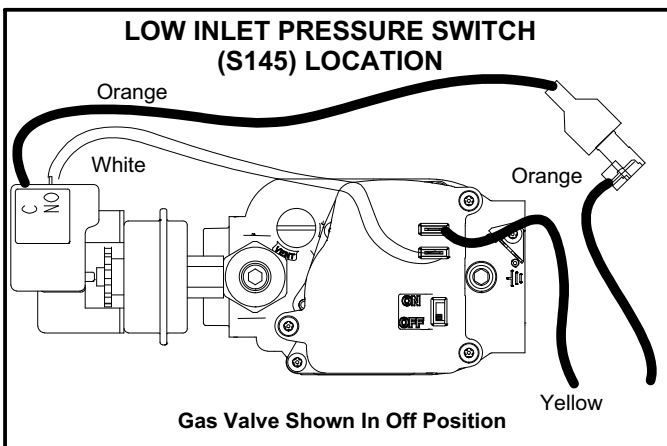


FIGURE 55

- 2 - When connecting gas supply, factors such as length of run, number of fittings and furnace rating must be considered to avoid excessive pressure drop. Table 9 lists recommended pipe sizes for typical applications.

**NOTE** - Use two wrenches when connecting gas piping to avoid transferring torque to the manifold.

- 3 - Gas piping must not run in or through air ducts, clothes chutes, chimneys or gas vents, dumb waiters or elevator shafts. Center gas line through piping hole. Gas line should not touch side of unit. See figures 57 and 58.

- 4 - Piping should be sloped 1/4 inch per 15 feet (6mm per 5.6m) upward toward the gas meter from the furnace. The piping must be supported at proper intervals, every 8 to 10 feet (2.44 to 3.05m), using suitable hangers or straps. Install a drip leg in vertical pipe runs to serve as a trap for sediment or condensate.

- 5 - A 1/8" N.P.T. plugged tap or pressure post is located on the gas valve to facilitate test gauge connection. See figure 61.

- 6 - In some localities, codes may require installation of a manual main shut-off valve and union (furnished by installer) external to the unit. Union must be of the ground joint type.

### ⚠ IMPORTANT

Compounds used on threaded joints of gas piping must be resistant to the actions of liquified petroleum gases.

#### Leak Check

After gas piping is completed, carefully check all piping connections (factory- and field-installed) for gas leaks. Use a leak detecting solution or other preferred means.

Never use an open flame to test for gas leaks. Check all connections using a commercially available soap solution made specifically for leak detection.

*The furnace must be isolated from the gas supply system by closing its individual manual shut-off valve during any pressure testing of the gas supply system at pressures less than or equal to 1/2 psig (3.48 kPa, 14 inches w.c.).*

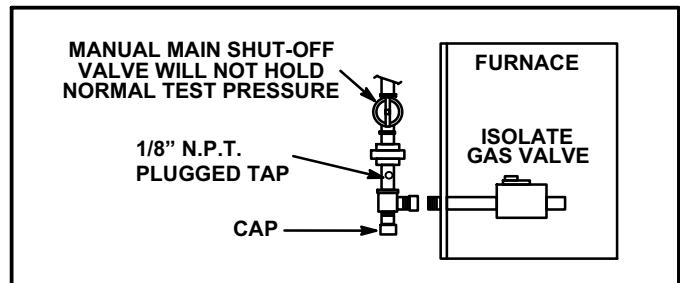


FIGURE 56

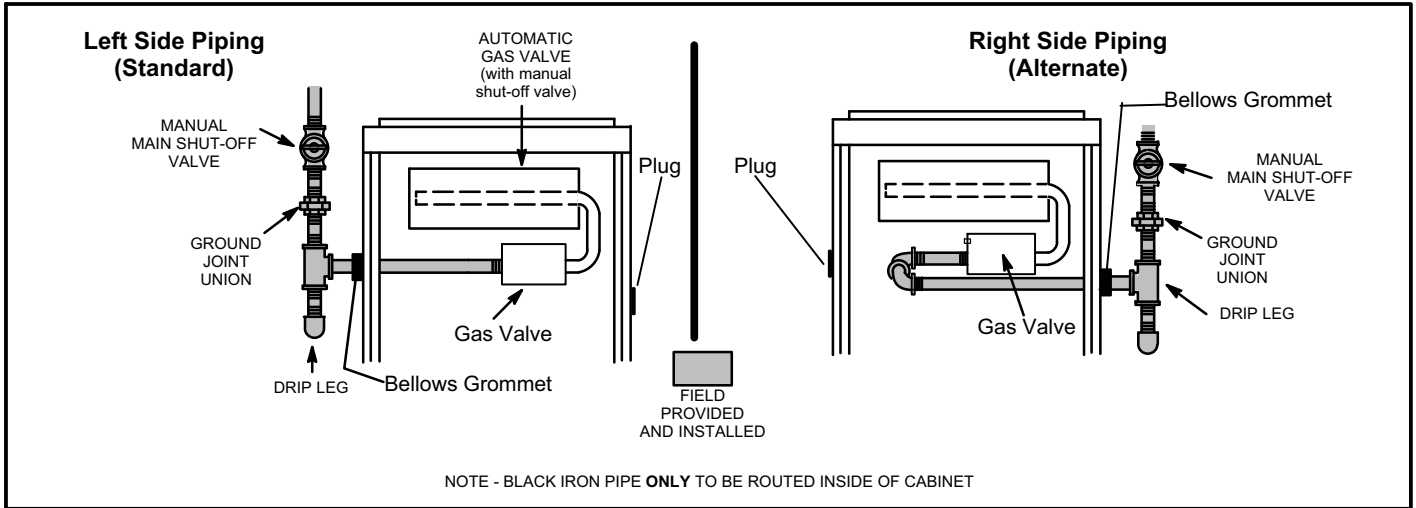
### ⚠ IMPORTANT

When testing pressure of gas lines, gas valve must be disconnected and isolated. See figure 56. Gas valves can be damaged if subjected to pressures greater than 1/2 psig (3.48 kPa).

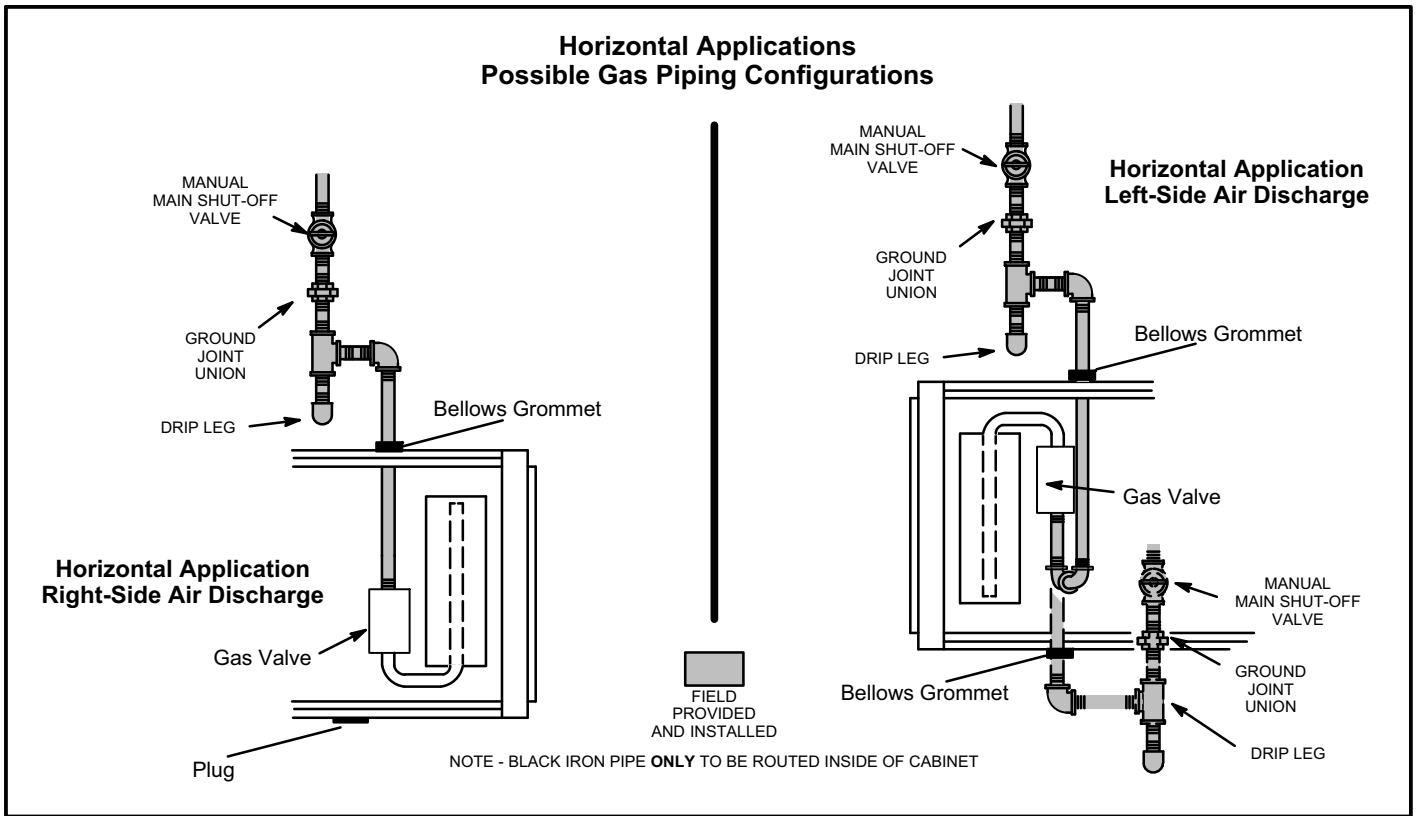
### ⚠ WARNING

#### FIRE OR EXPLOSION HAZARD

Failure to follow the safety warnings exactly could result in serious injury, death, or property damage. Never use an open flame to test for gas leaks. Check all connections using a commercially available soap solution made specifically for leak detection. Some soaps used for leak detection are corrosive to certain metals. Carefully rinse piping thoroughly after leak test has been completed.



**FIGURE 57**



**FIGURE 58**

**TABLE 9  
GAS PIPE CAPACITY - FT<sup>3</sup>/HR (KL/HR)**

Nominal Iron Pipe Size -Inches(mm)	Internal Diameter -Inches(mm)	Length of Pipe-Feet(m)									
		10 (3.048)	20 (6.096)	30 (9.144)	40 (12.192)	50 (15.240)	60 (18.288)	70 (21.336)	80 (24.384)	90 (27.432)	100 (30.480)
1/2 (12.7)	.622 (17.799)	175 (4.96)	120 (3.40)	97 (2.75)	82 (2.32)	73 (2.07)	66 (1.87)	61 (1.73)	57 (1.61)	53 (1.50)	50 (1.42)
3/4 (19.05)	.824 (20.930)	360 (10.19)	250 (7.08)	200 (5.66)	170 (4.81)	151 (4.28)	138 (3.91)	125 (3.54)	118 (3.34)	110 (3.11)	103 (2.92)
1 (25.4)	1.049 (26.645)	680 (19.25)	465 (13.17)	375 (10.62)	320 (9.06)	285 (8.07)	260 (7.36)	240 (6.80)	220 (6.23)	205 (5.80)	195 (5.52)
1-1/4 (31.75)	1.380 (35.052)	1400 (39.64)	950 (26.90)	770 (21.80)	660 (18.69)	580 (16.42)	530 (15.01)	490 (13.87)	460 (13.03)	430 (12.18)	400 (11.33)
1-1/2 (38.1)	1.610 (40.894)	2100 (59.46)	460 (41.34)	1180 (33.41)	990 (28.03)	900 (25.48)	810 (22.94)	750 (21.24)	690 (19.54)	650 (18.41)	620 (17.56)
2 (50.8)	2.067 (52.502)	3950 (111.85)	2750 (77.87)	2200 (62.30)	1900 (53.80)	1680 (47.57)	1520 (43.04)	1400 (39.64)	1300 (36.81)	1220 (34.55)	1150 (32.56)
2-1/2 (63.5)	2.469 (67.713)	6300 (178.39)	4350 (123.17)	3520 (99.67)	3000 (84.95)	2650 (75.04)	2400 (67.96)	2250 (63.71)	2050 (58.05)	1950 (55.22)	1850 (52.38)
3 (76.2)	3.068 (77.927)	11000 (311.48)	7700 (218.03)	6250 (176.98)	5300 (150.07)	4750 (134.50)	4300 (121.76)	3900 (110.43)	3700 (104.77)	3450 (97.69)	3250 (92.03)
4 (101.6)	4.026 (102.260)	23000 (651.27)	15800 (447.39)	12800 (362.44)	10900 (308.64)	9700 (274.67)	8800 (249.18)	8100 (229.36)	7500 (212.37)	7200 (203.88)	6700 (189.72)

**NOTE** - Capacity given in cubic feet of gas per hour (kilo liters of gas per hour) and based on 0.60 specific gravity gas.

**Removal of the Furnace from Common Vent**

In the event that an existing furnace is removed from a venting system commonly run with separate gas appliances, the venting system is likely to be too large to properly vent the remaining attached appliances.

Conduct the following test while each appliance is operating and the other appliances (which are not operating) remain connected to the common venting system. If the venting system has been installed improperly, you **must** correct the system as indicated in the general venting requirements section.

**⚠ WARNING**

**CARBON MONOXIDE POISONING HAZARD**

Failure to follow the steps outlined below for each appliance connected to the venting system being placed into operation could result in carbon monoxide poisoning or death.

The following steps shall be followed for each appliance connected to the venting system being placed into operation, while all other appliances connected to the venting system are not in operation:

- 1 - Seal any unused openings in the common venting system.
- 2 - Inspect the venting system for proper size and horizontal pitch. Determine that there is no blockage, restriction, leakage, corrosion, or other deficiencies which could cause an unsafe condition.

- 3 - Close all building doors and windows and all doors between the space in which the appliances remaining connected to the common venting system are located and other spaces of the building. Turn on clothes dryers and any appliances not connected to the common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.
- 4 - Follow the lighting instructions. Turn on the appliance that is being inspected. Adjust the thermostat so that the appliance operates continuously.
- 5 - After the main burner has operated for 5 minutes, test for leaks of flue gases at the draft hood relief opening. Use the flame of a match or candle.
- 6 - After determining that each appliance connected to the common venting system is venting properly, (step 3) return all doors, windows, exhaust fans, fireplace dampers, and any other gas-burning appliances to their previous mode of operation.
- 7 - If a venting problem is found during any of the preceding tests, the common venting system must be modified to correct the problem.

Resize the common venting system to the minimum vent pipe size determined by using the appropriate tables in Appendix G. (These are in the current standards of the National Fuel Gas Code ANSI Z223.1.

## Electrical

### ELECTROSTATIC DISCHARGE (ESD) Precautions and Procedures

#### ⚠ CAUTION



Electrostatic discharge can affect electronic components. Take precautions to neutralize electrostatic charge by touching your hand and tools to metal prior to handling the control.

#### INTERIOR MAKE-UP BOX INSTALLATION

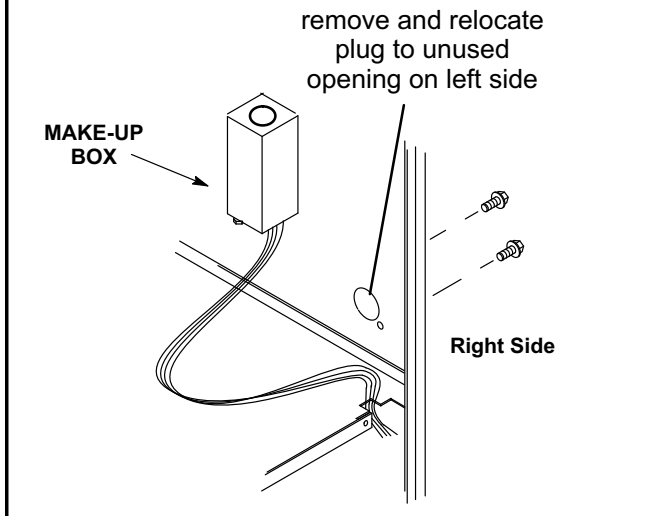


FIGURE 59

The unit is equipped with a field make-up box. The make-up box may be moved to the right side of the furnace to facilitate installation. Seal unused openings on left side with plugs removed from right side. Secure the excess wire to the existing harness to protect it from damage.

Refer to figure 60 for schematic wiring diagram and troubleshooting.

The power supply wiring must meet Class I restrictions. Protected by either a fuse or circuit breaker, select circuit protection and wire size according to unit nameplate.

**NOTE** - Unit nameplate states maximum current draw. Maximum Over-Current Protection allowed is 15 AMP.

Holes are on both sides of the furnace cabinet to facilitate wiring.

Install a separate (properly sized) disconnect switch near the furnace so that power can be turned off for servicing.

Before connecting the thermostat check to make sure the wires will be long enough for servicing at a later date. Make sure that thermostat wire is long enough to facilitate future removal of blower for service.

Complete the wiring connections to the equipment. Use the provided unit wiring diagram and the field wiring shown in figure 60. Use 18-gauge wire or larger that is suitable for Class II rating for thermostat connections.

Electrically ground the unit according to local codes or, in the absence of local codes, according to the current National Electric Code (ANSI/NFPA No. 70) for the USA and current Canadian Electric Code part 1 (CSA standard C22.1) for Canada. A green ground wire is provided in the field make-up box.

**NOTE** - The ML193UH furnace contains electronic components that are polarity sensitive. Make sure that the furnace is wired correctly and is properly grounded.

#### Accessory Terminals

One line voltage "EAC" 1/4" spade terminal is provided on the furnace integrated control. See figure 1 for integrated control configuration. This terminal is energized when the indoor blower is operating. Any accessory rated up to one amp can be connected to this terminal with the neutral leg of the circuit being connected to one of the provided neutral terminals. If an accessory rated at greater than one amp is connected to this terminal, it is necessary to use an external relay.

One line voltage "HUM" 1/4" spade terminal is provided on the furnace integrated control. See figure 1 for integrated control configuration. This terminal is energized in the heating mode when the combustion air inducer is operating. Any humidifier rated up to one amp can be connected to this terminal with the neutral leg of the circuit being connected to one of the provided neutral terminals. If a humidifier rated at greater than one amp is connected to this terminal, it is necessary to use an external relay.

#### Thermostat

Install the room thermostat according to the instructions provided with the thermostat. See figure 60 for thermostat designations. If the furnace is being matched with a heat pump, refer to the FM21 installation instruction or appropriate dual fuel thermostat instructions.

#### Indoor Blower Speeds

- 1 - When the thermostat is set to "FAN ON," the indoor blower will run continuously on the heating speed when there is no cooling or heating demand.
- 2 - When the ML193UH is running in the heating mode, the indoor blower will run on the heating speed.
- 3 - When there is a cooling demand, the indoor blower will run on the cooling speed.

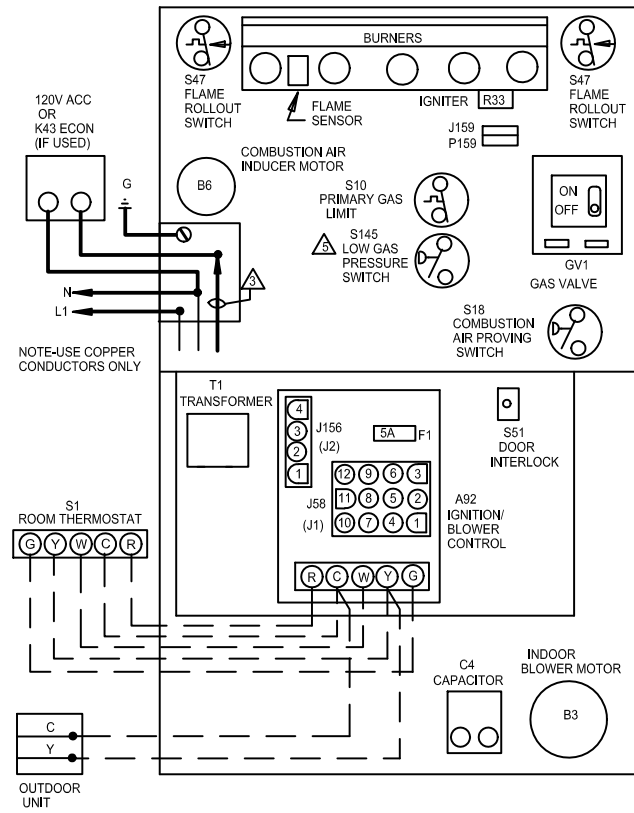
### Generator Use - Voltage Requirements

The following requirements must be kept in mind when specifying a generator for use with this equipment:

- The furnace requires 120 volts  $\pm$  10% (Range: 108 volts to 132 volts)
- The furnace operates at 60 Hz  $\pm$  5% (Range: 57 Hz to 63 Hz)

- The furnace integrated control requires both polarity and proper ground. Both polarity and proper grounding should be checked before attempting to operate the furnace on either permanent or temporary power
- Generator should have a wave form distortion of less than 5% THD (total harmonic distortion).

### TYPICAL ML193UH WIRING DIAGRAM



BLOWER SPEED CHART				
UNIT	FACTORY CONNECTED SPEED TAPS			MOTOR SPEEDS AVAIL.
	COOL	HEAT	PARK	
045P24B		YELLOW	BLACK, RED	4
045P36B		RED	BLACK, YELLOW	4
070P24B		BLACK	YELLOW, RED	4
070P36B		YELLOW	BLACK, RED	4
090P36C		YELLOW	BLACK, RED	4
090P48C		YELLOW	BLACK, RED	4
110P48C		BLACK	YELLOW, RED	4
110P60C		YELLOW	BLACK, RED	4
135P60D		YELLOW	BLACK, RED	4

← BLOWER SPEED SELECTION →

SPEED TAPS	BLACK	BROWN	YELLOW	RED	4
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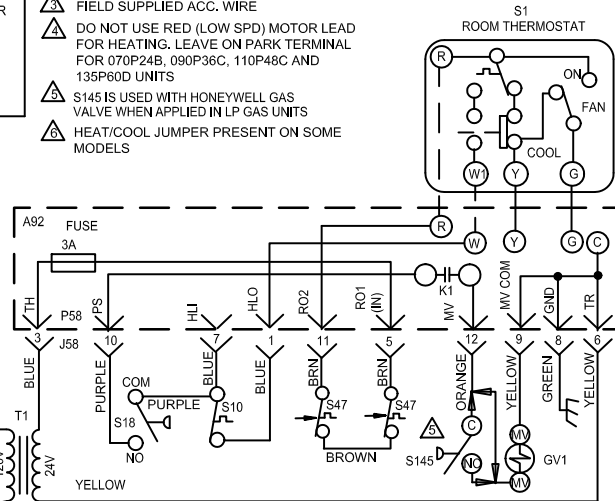
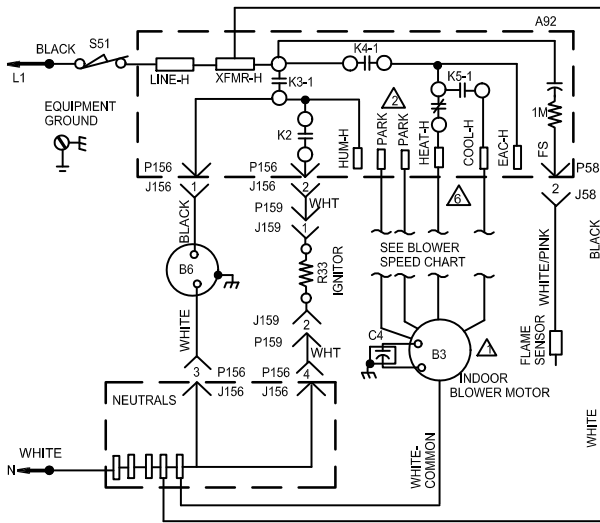
THERMOSTAT HEAT ANTICIPATION SETTINGS	
.65 AMP	HONEYWELL VALVE
.50 AMP	WHITE-RODGERS VALVE

JACKPLUG CHART	
J.P58	JACK/PLUG-BURNER CONTROL
J.P156	JACK/PLUG-INDUCER/IGNITER
J.P159	JACK/PLUG-IGNITER

**WARNING-**  
ELECTRIC SHOCK HAZARD. CAN CAUSE INJURY OR DEATH. UNIT MUST BE GROUNDED IN ACCORDANCE WITH NATIONAL AND LOCAL CODES

**NOTE-**  
IF ANY WIRE IN THIS APPLIANCE IS REPLACED, IT MUST BE REPLACED WITH WIRE OF LIKE SIZE, RATING, INSULATION THICKNESS AND TERMINATION

- ⚠ **IMPORTANT-** TO PREVENT MOTOR BURNOUT, NEVER CONNECT MORE THAN ONE LEAD TO ANY ONE CONNECTION
- ⚠ **PARK** TERMINALS ARE UNPOWERED TERMINALS. ALL UNUSED MOTOR LEADS MUST BE WIRED TO A PARK TERMINAL
- ⚠ **FIELD SUPPLIED ACC. WIRE**
- ⚠ **DO NOT USE RED (LOW SPD) MOTOR LEAD FOR HEATING. LEAVE ON PARK TERMINAL FOR 070P24B, 090P36C, 110P48C AND 135P60D UNITS**
- ⚠ **S145 IS USED WITH HONEYWELL GAS VALVE WHEN APPLIED IN LP GAS UNITS**
- ⚠ **HEAT/COOL JUMPER PRESENT ON SOME MODELS**

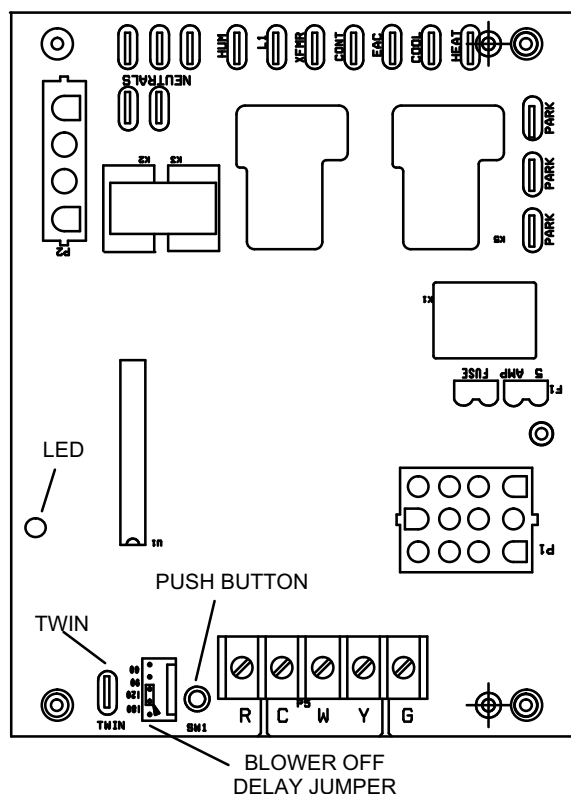


——— DENOTES OPTIONAL COMPONENTS  
 ——— LINE VOLTAGE FIELD INSTALLED  
 ——— CLASS II VOLTAGE FIELD WIRING

FIGURE 60

## Integrated Control

### INTEGRATED CONTROL (Automatic Hot Surface Ignition System)



	TERMINAL DESIGNATIONS
HUM	Humidifier (120VAC)
LINE	Input (120VAC)
XFMR	Transformer (120VAC)
EAC	Indoor Air Quality Accessory Air Cleaner (120VAC)
COOL	Blower - Cooling Speed (120VAC)
HEAT	Blower - Heating Speed (120VAC)
PARK	Dead terminals to park alternate spd taps
CONT	Continuous blower
NEUTRALS	Neutral terminals (120VAC)
TWIN	Twinning Terminal (24VAC)

FIGURE 1

### Integrated Control Diagnostic Codes

DIAGNOSTIC CODES	
LED Status	DESCRIPTION
LED Off	No power to control or control hardware fault detected.
LED On	Normal operation.
1 Flash	Flame present with gas valve de-energized.
2 Flashes	Pressure switch closed with combustion air inducer de-energized.
3 Flashes	Pressure switch open with combustion air inducer energized.
4 Flashes	Primary limit switch open.
5 Flashes	Rollout switch open.
6 Flashes	Pressure switch cycle lockout.
7 Flashes	Lockout, burners fail to light.
8 Flashes	Lockout, burners lost flame too many times.
9 Flashes	Line voltage polarity incorrect.

Note - This control is equipped with a push button switch for diagnostic code recall. The control stores the last 5 fault codes in non-volatile memory. The most recent fault code is flashed first, the oldest fault code is flashed last. There is a 2 second pause between codes. When the push button switch is pressed for less than 5 seconds, the control will flash the stored fault codes when the switch is released. The fault code history may be cleared by pressing the push button switch for more than 5 seconds.

## Unit Start-Up

FOR YOUR SAFETY READ BEFORE OPERATING

### ⚠ WARNING

Do not use this furnace if any part has been underwater. A flood-damaged furnace is extremely dangerous. Attempts to use the furnace can result in fire or explosion. Immediately call a qualified service technician to inspect the furnace and to replace all gas controls, control system parts, and electrical parts that have been wet or to replace the furnace, if deemed necessary.

### ⚠ WARNING



Danger of explosion. Can cause injury or product or property damage. Should the gas supply fail to shut off or if overheating occurs, shut off the gas valve to the furnace before shutting off the electrical supply.

### ⚠ CAUTION

Before attempting to perform any service or maintenance, turn the electrical power to unit OFF at disconnect switch.

**BEFORE LIGHTING** the unit, smell all around the furnace area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

The gas valve on the ML193UH is equipped with a gas control switch (lever). Use only your hand to move switch. Never use tools. If the the switch will not move by hand, do not try to repair it. Force or attempted repair may result in a fire or explosion.

#### Placing the furnace into operation:

ML193UH units are equipped with an automatic hot surface ignition system. Do not attempt to manually light burners on this furnace. Each time the thermostat calls for heat, the burners will automatically light. The ignitor does not get hot when there is no call for heat on these units.

#### Priming Condensate Trap

The condensate trap should be primed with water prior to start-up to ensure proper condensate drainage. Either pour 10 fl. oz. (300 ml) of water into the trap, or follow these steps to prime the trap:

- 1 - Follow the lighting instructions to place the unit into operation.
- 2 - Set the thermostat to initiate a heating demand.
- 3 - Allow the burners to fire for approximately 3 minutes.
- 4 - Adjust the thermostat to deactivate the heating demand.

- 5 - Wait for the combustion air inducer to stop. Set the thermostat to initiate a heating demand and again allow the burners to fire for approximately 3 minutes.
- 6 - Adjust the thermostat to deactivate the heating demand and wait for the combustion air inducer to stop. At this point, the trap should be primed with sufficient water to ensure proper condensate drain operation.

### ⚠ WARNING

If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury or death.

#### Gas Valve Operation (Figure 61)

- 1 - **STOP!** Read the safety information at the beginning of this section.
- 2 - Set the thermostat to the lowest setting.
- 3 - Turn off all electrical power to the unit.
- 4 - This furnace is equipped with an ignition device which automatically lights the burners. Do **not** try to light the burners by hand.
- 5 - Remove the upper access panel.
- 6 - Move gas valve switch to **OFF**. See figure 61.
- 7 - Wait five minutes to clear out any gas. If you then smell gas, **STOP!** Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions. If you do not smell gas go to next step.
- 8 - Move gas valve switch to **ON**. See figure 61.

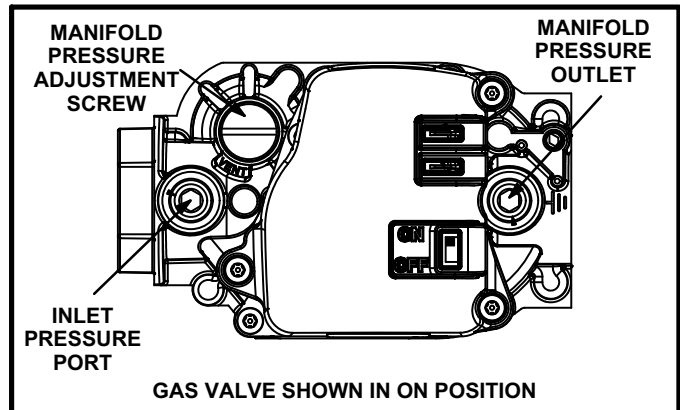


FIGURE 61

- 9 - Replace the upper access panel.
  - 10 - Turn on all electrical power to the unit.
  - 11 - Set the thermostat to desired setting.
- NOTE** - When unit is initially started, steps 1 through 11 may need to be repeated to purge air from gas line.
- 12 - If the appliance will not operate, follow the instructions "Turning Off Gas to Unit" and call your service technician or gas supplier.

#### Turning Off Gas to Unit

- 1 - Set the thermostat to the lowest setting.
- 2 - Turn off all electrical power to the unit if service is to be performed.
- 3 - Remove the upper access panel.



- 4 - Move gas valve switch to **OFF**.
- 5 - Replace the upper access panel.

**Failure To Operate**

If the unit fails to operate, check the following:

- 1 - Is the thermostat calling for heat?
- 2 - Are access panels securely in place?
- 3 - Is the main disconnect switch closed?
- 4 - Is there a blown fuse or tripped breaker?
- 5 - Is the filter dirty or plugged? Dirty or plugged filters will cause the limit control to shut the unit off.
- 6 - Is gas turned on at the meter?
- 7 - Is the manual main shut-off valve open?
- 8 - Is the internal manual shut-off valve open?
- 9 - Is the unit ignition system in lockout? If the unit locks out again, inspect the unit for blockages.

**Heating Sequence Of Operation**

- 1 - When thermostat calls for heat, combustion air inducer starts.
- 2 - Combustion air pressure switch proves blower operation. Switch is factory set and requires no adjustment.
- 3 - After a 15-second prepurge, the hot surface ignitor energizes.
- 4 - After a 20-second ignitor warm-up period, the gas valve solenoid opens. A 4-second Trial for Ignition period begins.”
- 5 - Gas is ignited, flame sensor proves the flame, and the combustion process continues.
- 6 - If flame is not detected after first ignition trial, the ignition control will repeat steps 3 and 4 four more times before locking out the gas valve (“WATCHGUARD” flame failure mode). The ignition control will then automatically repeat steps 1 through 6 after 60 minutes. To interrupt the 60-minute “WATCHGUARD” period, move thermostat from “Heat” to “OFF” then back to “Heat”. Heating sequence then restarts at step 1.

**Gas Pressure Adjustment**

**Gas Flow (Approximate)**

**TABLE 10**

GAS METER CLOCKING CHART				
ML193 Unit	Seconds for One Revolution			
	Natural		LP	
	1 cu ft Dial	2 cu ft Dial	1 cu ft Dial	2 cu ft DIAL
-045	80	160	200	400
-070	55	110	136	272
-090	41	82	102	204
-110	33	66	82	164
-135	27	54	68	136
Natural-1000 btu/cu ft		LP-2500 btu/cu ft		

Furnace should operate at least 5 minutes before checking gas flow. Determine time in seconds for **two** revolutions of gas through the meter. (Two revolutions assures a more accurate time.) **Divide by two** and compare to time in table 10 below. If manifold pressure matches table 11 and rate is incorrect, check gas orifices for proper size and restriction. Remove temporary gas meter if installed.

**NOTE** - To obtain accurate reading, shut off all other gas appliances connected to meter.

**Supply Pressure Measurement**

When testing supply gas pressure, use the 1/8” N.P.T. plugged tap or pressure post located on the gas valve to facilitate test gauge connection. See figure 61. Check gas line pressure with unit firing at maximum rate. Low pressure may result in erratic operation or underfire. High pressure can result in permanent damage to gas valve or overfire.

On multiple unit installations, each unit should be checked separately, with and without units operating. Supply pressure must fall within range listed in table 11.

**Manifold Pressure Measurement**

- 1 - Remove the threaded plug from the outlet side of the gas valve and install a field-provided barbed fitting. Connect to a manometer to measure manifold pressure.
- 2 - Start unit and allow 5 minutes for unit to reach steady state.
- 3 - While waiting for the unit to stabilize, observe the flame. Flame should be stable and should not lift from burner. Natural gas should burn blue.
- 4 - After allowing unit to stabilize for 5 minutes, record manifold pressure and compare to value given in table 11.

**NOTE** - Shut unit off and remove manometer as soon as an accurate reading has been obtained. Take care to remove barbed fitting and replace threaded plug.

**TABLE 11**

**Supply Line and Manifold Pressure (inches w.c.)**

Unit	Fuel	Manifold Pressure	Line Pressure
All	Nat. Gas	3.5	4.5 - 10.5
All	L.P. Gas	10.0	11.0 - 13.0

**NOTE** - A natural to L.P. propane gas changeover kit is necessary to convert this unit. Refer to the changeover kit installation instruction for the conversion procedure.

## Proper Combustion

Furnace should operate minimum 15 minutes with correct manifold pressure and gas flow rate before checking combustion. Take combustion sample beyond the flue outlet and compare to the tables below.

**TABLE 12**

ML193 Unit	CO <sub>2</sub> % For Nat	CO <sub>2</sub> % For L.P.
-045	7.2 - 7.9	8.6 - 9.3
-070		
-090		
-110		
-135		

The maximum carbon monoxide reading should not exceed 50 ppm.

## High Altitude Information

**NOTE** - In Canada, certification for installations at elevations over 4500 feet (1372 m) is the jurisdiction of local authorities.

ML193UH units require no manifold pressure adjustments for operation at altitudes up to 10,000 feet (3048 m) above sea level. Units installed at altitude of 4501 - 10,000 feet (1373 to 3048m) require a pressure switch change which can be ordered separately. Table 13 lists conversion kit and pressure switch requirements at varying altitudes.

The combustion air pressure switch is factory-set and requires no adjustment.

**NOTE** - A natural to LP/propane gas changeover kit is necessary to convert this unit. Refer to the changeover kit installation instruction for the conversion procedure.

**TABLE 13**  
Conversion Kit and Pressure Switch Requirements at Varying Altitudes

ML193 Unit	Natural to LP/Propane	High Altitude Natural Burner Orifice Kit	LP/Propane to Natural	High Altitude LP/Propane Burner Orifice Kit	High Altitude Pressure Switch	
	0 - 7500 ft (0 - 2286m)	7501 - 10,000 ft (2286 - 3038m)	0 - 7500 ft (0 - 2286m)	7501 - 10,000 ft (2286 - 3038m)	4501 - 7500 ft (1373 - 2286m)	7501 -10,000 ft (2286 - 3048m)
-045	*69W73	73W37	*73W81	*68W68	93W87	93W88
-070						
-090						
-110						
-135						

\* Conversion requires installation of a gas valve manifold spring which is provided with the gas conversion kit. Pressure switch is factory set. No adjustment necessary. All models use the factory-installed pressure switch from 0-4500 feet (0-1370 m).

## Testing for Proper Venting and Sufficient Combustion Air for Non-Direct Vent Applications

### **WARNING**

#### **CARBON MONOXIDE POISONING HAZARD!**

**Failure to follow the steps outlined below for each appliance connected to the venting system being placed into operation could result in carbon monoxide poisoning or death.**

**The following steps shall be followed for each appliance connected to the venting system being placed into operation, while all other appliances connected to the venting system are not in operation.**

After the ML193UH gas furnace has been started, the following test should be conducted to ensure proper venting and sufficient combustion air has been provided to the ML193UH as well as to other gas-fired appliances which are separately vented.

If a ML193UH furnace replaces a Category I furnace which was commonly vented with another gas appliance, the size of the existing vent pipe for that gas appliance must be checked. Without the heat of the original furnace flue products, the existing vent pipe is probably oversized for the single water heater or other appliance. The vent should be checked for proper draw with the remaining appliance.

The test should be conducted while all appliances (both in operation and those not in operation) are connected to the venting system being tested. If the venting system has been installed improperly, or if provisions have not been made for sufficient amounts of combustion air, corrections must be made as outlined in the previous section.

- 1 - Seal any unused openings in the venting system.
- 2 - Visually inspect the venting system for proper size and

horizontal pitch. Determine there is no blockage or restriction, leakage, corrosion, or other deficiencies which could cause an unsafe condition.

- 3 - To the extent that it is practical, close all building doors and windows and all doors between the space in which the appliances connected to the venting system are located and other spaces of the building.
- 4 - Close fireplace dampers.
- 5 - Turn on clothes dryers and any appliances not connected to the venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at maximum speed. Do not operate a summer exhaust fan.
- 6 - Follow the lighting instruction to place the appliance being inspected into operation. Adjust thermostat so appliance will operate continuously.
- 7 - Use the flame of match or candle to test for spillage of flue gases at the draft hood relief opening after 5 minutes of main burner operation.
- 8 - If improper venting is observed during any of the above tests, the venting system must be corrected or sufficient combustion/make-up air must be provided. The venting system should be re-sized to approach the minimum size as determined by using the appropriate tables in appendix G in the current standards of the National Fuel Gas Code ANSI-Z223.1/NPFA 54 in the U.S.A., and the appropriate Natural Gas and Propane appliances venting sizing tables in the current standard of the CSA-B149 Natural Gas and Propane Installation Codes in Canada.
- 9 - After determining that each appliance remaining connected to the common venting system properly vents when tested as indicated in step 3, return doors, windows, exhaust fans, fireplace dampers and any other gas-burning appliance to their previous condition of use.

## Other Unit Adjustments

### Primary Limit.

The primary limit is located on the heating compartment vestibule panel. This limit is factory set and requires no adjustment.

### Flame Rollout Switches (Two)

These manually reset switches are located on the front of the burner box.

### Pressure Switch

The pressure switch is located in the heating compartment on the cold end header box. This switch checks for proper combustion air inducer operation before allowing ignition trial. The switch is factory-set and must not be adjusted.

### Temperature Rise

After the furnace has been started and supply and return air temperatures have been allowed to stabilize, check the temperature rise. If necessary, adjust the blower speed to maintain the temperature rise within the range shown on the unit nameplate. Increase the blower speed to decrease the temperature. Decrease the blower speed to increase the temperature rise. Failure to adjust the temperature rise may cause erratic limit operation.

### Fan Control

The fan on time of 30 seconds is not adjustable. The fan off delay (amount of time that the blower operates after the heat demand has been satisfied) may be adjusted by changing the jumper position across the five pins on the integrated control. The unit is shipped with a factory fan off setting of 120 seconds. The fan off delay affects comfort and is adjustable to satisfy individual applications. Adjust the fan off delay to achieve a supply air temperature between 90° and 110°F at the moment that the blower is de-energized. Longer off delay settings provide lower return air temperatures; shorter settings provide higher return air temperatures. See figure 62.

### Electrical

- 1 - Check all wiring for loose connections.
- 2 - Check for the correct voltage at the furnace (furnace operating). Correct voltage is 120VAC  $\pm$  10%
- 3 - Check amp-draw on the blower motor with blower access panel in place.  
Motor Nameplate \_\_\_\_\_ Actual \_\_\_\_\_

### Blower Speeds

Follow the steps below to change the blower speeds.

- 1 - Turn off electrical power to furnace.
- 2 - Remove blower access panel.
- 3 - Disconnect existing speed tap at integrated control speed terminal.

## HEAT FAN-OFF TIME IN SECONDS

JUMPER POSITION		HEAT OFF DELAY
PIN1	PIN2	60
PIN2	PIN3	90
PIN3	PIN4	120
PIN4	PIN5	180
NO JUMPER		180

To adjust fan-off timing, reposition jumper across pins to achieve desired setting.

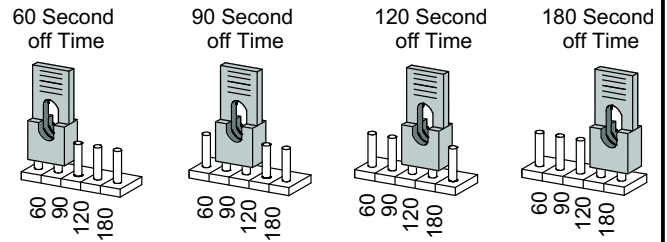


FIGURE 62

**NOTE** - Termination of any unused motor leads must be insulated.

- 4 - Place unused blower speed tap on integrated control "PARK" terminal or insulate.
- 5 - Refer to blower speed selection chart on unit wiring diagram for desired heating or cooling speed. See *Product Specifications bulletin* for blower performance tables.
- 6 - Connect selected speed tap at integrated control speed terminal.
- 7 - Resecure blower access panel.
- 8 - Turn on electrical power to furnace.
- 9 - Recheck temperature rise.

### Electronic Ignition

The integrated control has an added feature of an internal Watchguard control. The feature serves as an automatic reset device for integrated control lockout caused by ignition failure. This type of lockout is usually due to low gas line pressure. After one hour of continuous thermostat demand for heat, the Watchguard will break and remake thermostat demand to the furnace and automatically reset the integrated control to begin the ignition sequence.

### Exhaust and Air Intake Pipe

- 1 - Check exhaust and air intake connections for tightness and to make sure there is no blockage.
- 2 - Is pressure switch closed? Obstructed exhaust pipe will cause unit to shut off at pressure switch. Check termination for blockages.
- 3 - Obstructed pipe or termination may cause rollout switches to open. Reset manual flame rollout switches on burner box assembly if necessary.

## Twinning the ML193UH

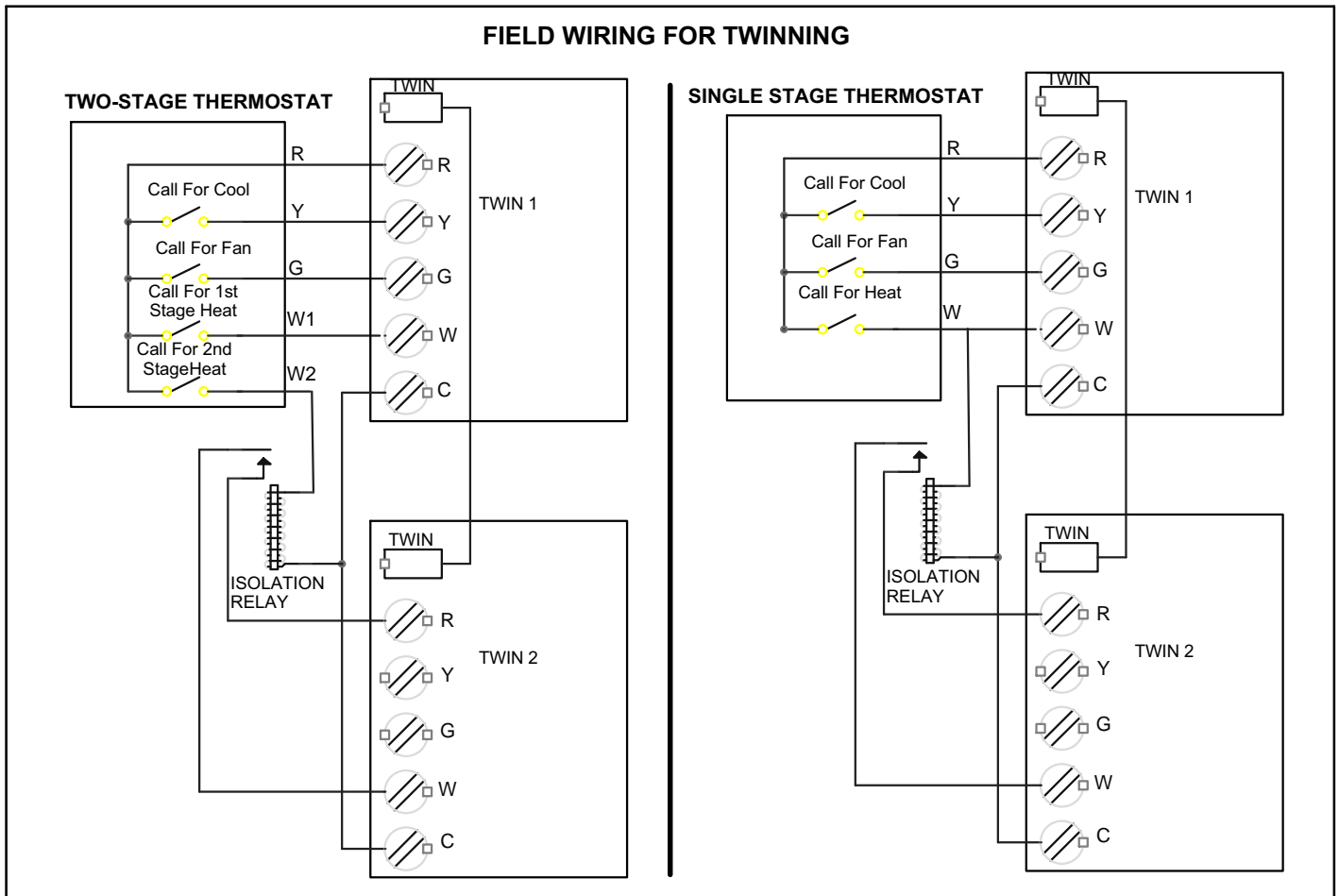
The control board in this furnace is equipped with a provision to "twin" (interconnect) two(2) adjacent furnaces with a common plenum such that they operate as one (1) large unit.

When twinned, the circulating blower speeds are synchronized between the furnaces. If either furnace has a need to run the blower, both furnaces will run the blower on the same speed. The cooling speed has highest priority, followed by heating speed and fan speed.

Field installation of twinning consists of connecting wires

between the "C" and "Twin" terminals of the two controls. The 24 VAC secondary of the two systems must be in phase. All thermostat connections are made to one control only. Figure 2 show wiring for two-stage and single stage thermostats.

The twinned furnace without thermostat connections is to have the call for heat supplied by an external 24VAC isolation relay to prevent its rollout switch from being bypassed by the other twinned furnace. The coil of the isolation relay connects from the thermostat "W" to 24 VAC common. The contacts of the relay connect "R" to "W" on the non-thermostat twin.



**FIGURE 2**

## Service

### **WARNING**

#### **ELECTRICAL SHOCK, FIRE, OR EXPLOSION HAZARD.**

Failure to follow safety warnings exactly could result in dangerous operation, serious injury, death or property damage.

Improper servicing could result in dangerous operation, serious injury, death, or property damage.

Before servicing, disconnect all electrical power to furnace.

When servicing controls, label all wires prior to disconnecting. Take care to reconnect wires correctly.

Verify proper operation after servicing.

At the beginning of each heating season, system should be checked as follows by a qualified service technician:

#### **Blower**

Check the blower wheel for debris and clean if necessary. The blower motors are prelubricated for extended bearing life. No further lubrication is needed.

### **WARNING**

The blower access panel must be securely in place when the blower and burners are operating. Gas fumes, which could contain carbon monoxide, can be drawn into living space resulting in personal injury or death.

#### **Filters**

All air filters are installed external to the unit. Filters should be inspected monthly. Clean or replace the filters when necessary to ensure proper furnace operation. Table 1 lists recommended filter sizes.

#### **Exhaust and air intake pipes**

Check the exhaust and air intake pipes and all connections for tightness and to make sure there is no blockage.

**NOTE** - After any heavy snow, ice or frozen fog event the furnace vent pipes may become restricted. Always check the vent system and remove any snow or ice that may be obstructing the plastic intake or exhaust pipes.

#### **Electrical**

- 1 - Check all wiring for loose connections.
- 2 - Check for the correct voltage at the furnace (furnace operating).
- 3 - Check amp-draw on the blower motor.  
Motor Nameplate \_\_\_\_\_ Actual \_\_\_\_\_

#### **Winterizing and Condensate Trap Care**

- 1 - Turn off power to the furnace.
- 2 - Have a shallow pan ready to empty condensate water.
- 3 - Remove the clean out cap from the condensate trap and empty water. Inspect the trap then reinstall the clean out cap.

#### **Cleaning the Burner Assembly**

- 1 - Turn off gas and electrical power to the furnace. Remove heating compartment access panel.
- 2 - Disconnect the gas supply line from the gas valve.
- 3 - Disconnect and label wires from gas valve.
- 4 - Disconnect ignitor wiring at 2 circuit plug.
- 5 - Disconnect and label wires from rollout switch.
- 6 - Disconnect and label flame sensor wire.
- 7 - Disconnect and label ground wire from burner/manifold assembly.
- 8 - Remove four screws that secures burner/manifold assembly to vestibule. Remove the assembly and make note not to allow ignitor plate to dislodge from the assembly.
- 9 - Gently clean the face of the burners using the soft brush attachment on a vacuum cleaner. Visually inspect the inside of the burners and crossovers for any blockage caused by foreign matter. Remove any blockage.
- 10 - Reinstall the burner/manifold assembly using the existing four screws. **Burners are self aligning to center of clam shells.**
- 11 - Reconnect ground wire.
- 12 - Reconnect flame sensor wire.
- 13 - Reconnect rollout switch wires.
- 14 - Reconnect ignitor wires.
- 15 - Reconnect gas valve wires.
- 16 - Reconnect gas supply line to gas valve.
- 17 - Refer to instructions on verifying gas and electrical connections when re-establishing supplies.
- 18 - Follow instructions to place furnace in operation. Run furnace 5 minutes to ensure burners are clean and operating correctly.
- 19 - Replace heating compartment access panel.

## Repair Parts List

The following repair parts are available through Lennox dealers. When ordering parts, include the complete furnace model number listed on the CSA nameplate -- Example: ML193UH045XP36B-01. **All service must be performed by a licensed professional installer (or equivalent), service agency, or gas supplier.**

### Cabinet Parts

- Upper access panel
- Blower access panel
- Top Cap

### Control Panel Parts

- Transformer
- Integrated control board
- Door interlock switch

### Blower Parts

- Blower wheel
- Motor
- Motor mounting frame
- Motor capacitor
- Blower housing cutoff plate

### Heating Parts

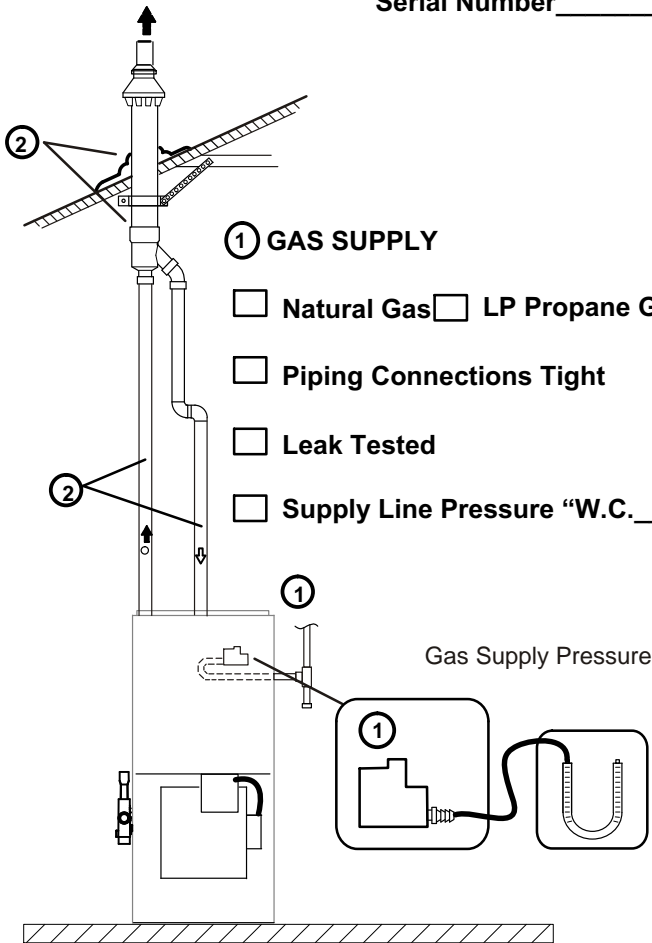
- Flame Sensor
- Heat exchanger assembly
- Gas manifold
- Combustion air inducer
- Gas valve
- Main burner cluster
- Main burner orifices
- Pressure switch
- Ignitor
- Primary limit control
- Flame rollout switches

# Start-Up & Performance Check List

## UNIT SET UP

Furnace:  
Model Number \_\_\_\_\_

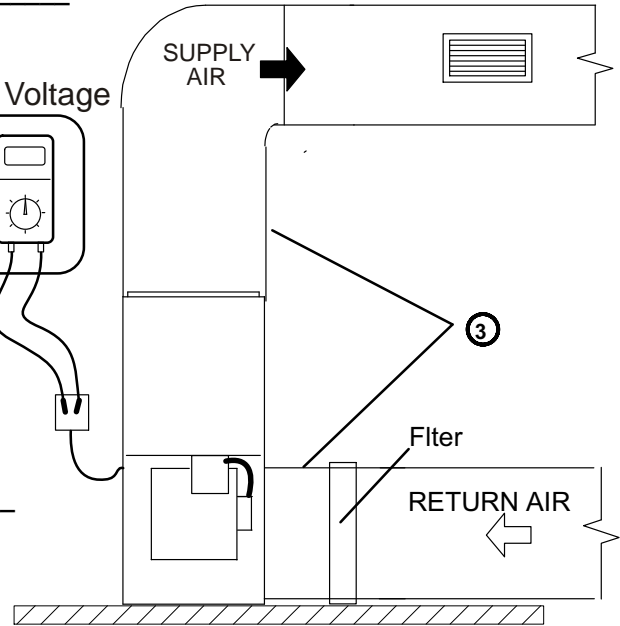
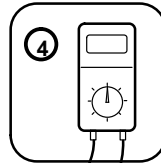
Serial Number \_\_\_\_\_



### ① GAS SUPPLY

- Natural Gas  LP Propane Gas
- Piping Connections Tight
- Leak Tested
- Supply Line Pressure "W.C." \_\_\_\_\_

Line Voltage



### ③ DUCT SYSTEM SUPPLY AIR DUCT

- Sealed
- Insulated (if necessary)

### RETURN DUCT

- Sealed
- Filter Installed and Clean
- Grilles Unobstructed

### ④ VOLTAGE CHECK

Supply Voltage \_\_\_\_\_

- Electrical Connections Tight

### ② INTAKE / EXHAUST PIPE

- All Joints Primed and Glued
- Terminations Installed Properly
- Horizontal Pipes Sloped (if applicable)
- Condensate Trap Primed / Line Sloped
- Pipes Supported
- Heat Cable Installed and Operable (if applicable)



## UNIT OPERATION

### HEATING MODE

### COOLING MODE

- ① GAS MANIFOLD PRESSURE "W.C. \_\_\_\_\_
- ② COMBUSTION SAMPLE CO<sub>2</sub>% \_\_\_\_\_ CO PPM \_\_\_\_\_
- ③ INDOOR BLOWER AMPS \_\_\_\_\_
- ④ TEMPERATURE RISE  
 Supply Duct Temperature \_\_\_\_\_  
 Return Duct Temperature - \_\_\_\_\_  
 Temperature Rise = \_\_\_\_\_
- ⑤ TOTAL EXTERNAL STATIC  
 Supply External Static \_\_\_\_\_  
 Return External Static + \_\_\_\_\_  
 Total External Static = \_\_\_\_\_

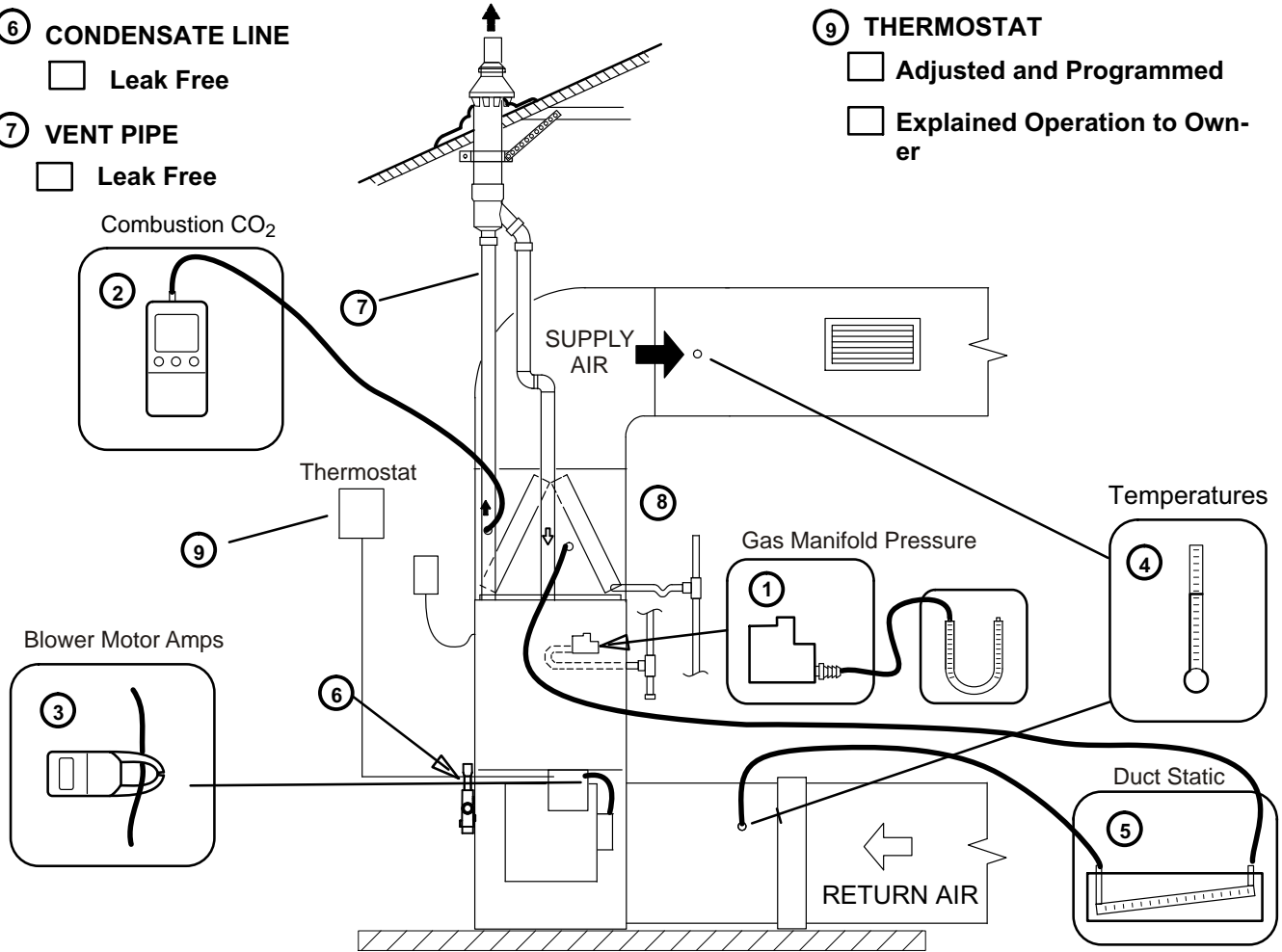
- ③ INDOOR BLOWER AMPS \_\_\_\_\_
- ④ TEMPERATURE DROP  
 Return Duct Temperature \_\_\_\_\_  
 Supply Duct Temperature - \_\_\_\_\_  
 Temperature Drop = \_\_\_\_\_
- ⑤ TOTAL EXTERNAL STATIC (dry coil)  
 Supply External Static \_\_\_\_\_  
 Return External Static + \_\_\_\_\_  
 Total External Static = \_\_\_\_\_

- ⑥ CONDENSATE LINE  
 Leak Free

- ⑧ DRAIN LINE  
 Leak Free

- ⑦ VENT PIPE  
 Leak Free

- ⑨ THERMOSTAT  
 Adjusted and Programmed  
 Explained Operation to Owner



Contractor's: Name \_\_\_\_\_ Telephone \_\_\_\_\_ Checklist Completed \_\_\_\_\_

Job Address \_\_\_\_\_ - \_\_\_\_\_ Technician's Name \_\_\_\_\_

## Requirements for Commonwealth of Massachusetts

### Modifications to NFPA-54, Chapter 10

#### Revise NFPA-54 section 10.8.3 to add the following requirements:

For all side wall, horizontally vented, gas-fueled equipment installed in every dwelling, building or structure used in whole or in part for residential purposes, including those owned or operated by the Commonwealth and where the side wall exhaust vent termination is less than seven (7) feet above the finished grade in the area of the venting, including but not limited to decks and porches, the following requirements shall be satisfied:

- 1 - **INSTALLATION OF CARBON MONOXIDE DETECTORS.** At the time of installation of the side wall, horizontally vented, gas-fueled equipment, the installing plumber or gasfitter shall observe that a hard-wired carbon monoxide detector with an alarm and battery backup is installed on the floor level where the gas equipment is to be installed. In addition, the installing plumber or gasfitter shall observe that a battery-operated or hard-wired carbon monoxide detector with an alarm is installed on each additional level of the dwelling, building or structure served by the side wall, horizontally vented, gas-fueled equipment. It shall be the responsibility of the property owner to secure the services of qualified licensed professionals for the installation of hard-wired carbon monoxide detectors.
  - a - In the event that the side wall, horizontally vented, gas-fueled equipment is installed in a crawl space or an attic, the hard-wired carbon monoxide detector with alarm and battery back-up may be installed on the next adjacent floor level.
  - b - In the event that the requirements of this subdivision cannot be met at the time of completion of installation, the owner shall have a period of thirty (30) days to comply with the above requirements; provided, however, that during said thirty (30) day period, a battery-operated carbon monoxide detector with an alarm shall be installed.
- 2 - **APPROVED CARBON MONOXIDE DETECTORS.** Each carbon monoxide detector as required in accordance with the above provisions shall comply with NFPA 720 and be ANSI/UL 2034 listed and IAS certified.
- 3 - **SIGNAGE.** A metal or plastic identification plate shall be permanently mounted to the exterior of the building at a minimum height of eight (8) feet above grade directly in line with the exhaust vent terminal for the horizontally vented, gas-fueled heating appliance or equipment. The sign shall read, in print size no less than one-half (1/2) inch in size, "GAS VENT DIRECTLY BELOW. KEEP CLEAR OF ALL OBSTRUCTIONS."

- 4 - **INSPECTION.** The state or local gas inspector of the side wall, horizontally vented, gas-fueled equipment shall not approve the installation unless, upon inspection, the inspector observes carbon monoxide detectors and signage installed in accordance with the provisions of 248 CMR 5.08(2)(a) 1 through 4.

#### **EXEMPTIONS: The following equipment is exempt from 24 CMR 5.08(2)(a) 1 through 4:**

- 1 - The equipment listed in Chapter 10 entitled "Equipment Not Required to Be Vented" in the most current edition of NFPA 54 as adopted by the Board; and
- 2 - Product Approved side wall, horizontally vented, gas-fueled equipment installed in a room or structure separate from the dwelling, building or structure used in whole or in part for residential purposes.

#### **MANUFACTURER REQUIREMENTS - GAS EQUIPMENT VENTING SYSTEM PROVIDED.**

When the manufacturer of Product Approved side wall, horizontally vented, gas-fueled equipment provides a venting system design or venting system components with the equipment, the instructions provided by the manufacturer for installation of the equipment and the venting system shall include:

- 1 - Detailed instructions for the installation of the venting system design or the venting system components: and
- 2 - A complete parts list for the venting system design or venting system.

#### **MANUFACTURER REQUIREMENTS - GAS EQUIPMENT VENTING SYSTEM NOT PROVIDED.**

When the manufacturer of Product Approved side wall, horizontally vented, gas-fueled equipment does not provide the parts for venting the flue gases, but identifies "special venting systems," the following requirements shall be satisfied by the manufacturer:

- 1 - The referenced "special venting system" instructions shall be included with the appliance or equipment installation instructions; and
- 2 - The "special venting systems" shall be Product Approved by the Board, and the instructions for that system shall include a parts list and detailed installation instructions.

**A copy of all installation instructions for all Product Approved side wall, horizontally vented, gas-fueled equipment, all venting instructions, all parts lists for venting instructions, and/or all venting design instructions shall remain with the appliance or equipment at the completion of the installation.**

## **FOR THE PROVINCE OF ONTARIO, HORIZONTAL SIDEWALL VENT APPLICATIONS ONLY**

For exterior horizontal venting applications, the 2" X 1.5" reducer for 2" venting at the point where the exhaust pipe exits the structure is not required in direct or non-direct vent applications in the Province of Ontario. In these applications, the vent should be oriented such that the exhaust

plume is unobjectionable. If the installation requires more separation between the flue gases and the building structure, a reducer may be installed on the exhaust pipe to increase the flue gas velocity.